

Marine Mammals

01	N. fur seal	Callorhinus ursinus
02	Dall's porpoise	Phocoenoides dalli
03	N. right whale dolphin	Lissodelphis borealis
04	Pacific white sided	Lagenorhynchus obliquidens
05	Common dolphin	Delphinus delphis
06	Striped dolphin	Stenella coeruleoalba
07	Other marine mammal	

Seabirds

Shearwaters		
11	Sooty	Puffinus griseus
12	Slender-billed (short-tailed)	P. tenuirostris
13	Flesh-footed	P. carneipes
14	Wedge-tailed	P. pacificus
15	N. fulmar	Fulmarus glacialis
16	Buller's	P. bulleri
17	Unidentified dark shearwaters	

Albatrosses

21	Short-tailed	Diomedes albatrus
22	Black-footed	Diomedes nigripes
23	Laysan	Diomedes immutabilis

Salmonids

41	Sockeye	Oncorhynchus nerka
42	Chum	O. keta
43	Pink	O. gorbuscha
44	Coho	O. kisutch
45	Chinook	O. tshawytscha
46	Steelhead	O. mykiss
47	Unidentified	

Fish and Squid

70	Neon flying squid	Ommastrephes bartramii
71	Boreal clubhook squid	Onchoteuthis borealioanatica
72	Eight-armed squid	Gonatopsis borealis
73	Pomfret	Brama japonica
74	Yellowtail	Seriola lalandi
75	Blue shark	Lamna nasus
51	Albacore	Thunnus alalunga
52	Skipjack	Euthynnus pelamis

Other animals (Seabirds)	
31	Tufted puffin
32	Horned puffin
33	Leach's storm petrel
34	Other seabirds

Lunda sirrhata
Exetercula corniculata
Oceanodroma leucorhoa

Other Animals (Fish)	
53	Bluefin tuna
54	Yellowfin tuna
55	Bigeye tuna
56	Unidentified tuna
57	Swordfish
58	Striped marlin
59	Blue marlin
60	Sailfish
61	Shortbill spearfish
62	Unidentified "marlin"
63	Bullet tuna

Thunnus thynnus
Thunnus albacares
Thunnus obesus
Xiphias gladius
Tetrapturus audax
Makaira mazara
Istiophorus platypterus
? Tetrapturus angustirostris
Auxis rochei

Other Animals (Turtles)

35	Sea turtle
36	Loggerhead
37	Leatherback
38	Kemp's Ridley
39	Hawksbill
40	Green

Caretta caretta
Dermochelya coriacea
Lepidochelys kempi
Eratichelys imbricata
Chelonia mydas

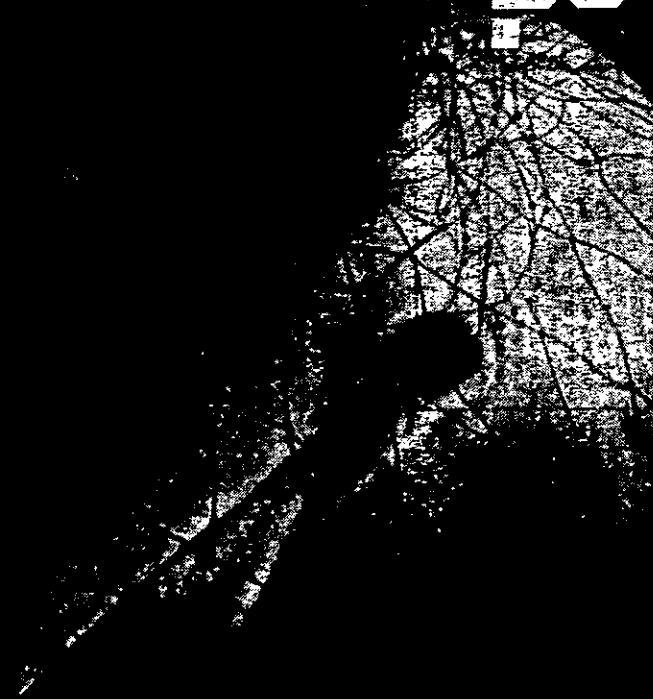
E 8 The Seattle Times Monday, June 12, 1989

(Paid Advertisement)

(Paid Advertisement)

**THIS DOLPHIN
NEVER SAW WHAT
KILLED HER**

CAN YOU?



As the blood-red glow of sunset flashes across the Pacific, a secret slaughter begins. The driftnet fleet of a thousand ships and support vessels from Japan, Taiwan and South Korea unfurls its wall of death—30,000 miles of fine monofilament netting almost invisible to the human eye—totally undetectable by seals, whales and salmon, dolphins, seals and seabirds.

Each net sweeping through the darkness snags and drowns every living creature in an arc forty feet deep and an incredible forty miles long. The driftnet fleet is "officially" after only one thing—night-feeding squid for the Asian market.

But the cold light of morning reveals a grisly harvest of dolphin mothers and babies, rare giant sea turtles, marlin, tuna, swordfish, and a vast, illegal booty of North American salmon quickly iced down and stashed below decks.

Driftnets are also implicated in the death of countless humpback whale calves that vanish between Hawaii and Alaskan feeding grounds. Driftnet captains admit they are often forced to cut loose miles of driftnet when whales become entangled in it.

Nets lost in the night remain drifting death traps. These "ghost nets" strumline the seas with such ghastly efficiency they sink with the weight of their catch. As the corpses decompose, the net rises toward the surface to

WHERE HAVE ALL THE SALMON GONE?

- Re: Singapore frozen salmon (caught in North Pacific). We can presently offer you on behalf of one of our largest driftnet fleets, 150 tons of headless coho salmon, 200 tons of headless red sockeye (70s 2 to 4 lbs and 30s 4 to 6 lbs), and 50 tons headless silver salmon.

trap a fresh load of victims before sinking again. This cycle of destruction continues indefinitely. The nets are high-tensile plastic. They never wear out, never tire of killing. In the ten years since driftnet began sweeping through the North Pacific, they have wreaked more havoc on the marine ecosystem than all the fishing and whaling in history. A driftnet's power to utterly destroy aquatic life is beyond dispute. Japan, which has the largest driftnet fleet, has forbidden driftnetting within a thousand miles of its own coastal waters.

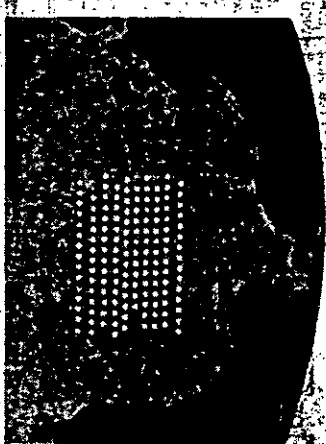
Meanwhile, a sharp drop in the North American salmon catch in the last two years is shockingly simple to explain: Asian fish markets are literally flooded with salmon intercepted by the "red squid" fleet. In 1988, one Singapore wholesaler alone boasted of having 7,500 metric tons of salmon on hand. That's about two-and-a-half million fish.

But the impact of driftnetting will be felt far beyond the salmon market. The whole intricate pattern of life in the North Pacific is in danger.



Photo documentation by the 1988 expedition showed the driftnet fleet—part of the fast-growing coalition of environmental and fishermen's organizations now struggling to halt the driftnet slaughter in the North Pacific.

In fact, unless we take immediate action, the world's largest ocean will be a wasteland. What can we do to the land driftnet does to the sea?



The red squid fleet sails north in the summer and south in the winter, destroying vast numbers of the open sea between Hawaii and the Aleutians. The deadline to stop them is June 29, 1989.

What actually expounds driftnetting instead of banning it. This outrageous error must be corrected now. Please, mail the coupon today. Before another night of killing sweeps across the North Pacific.

DEADLINE: JUNE 29, 1989

Add my name to your Emergency Petition. Demand that Secretary of State Baker get tough with nations whose driftnet fleets threaten the very life of the North Pacific, including salmon fisheries, by the June 29 deadline.

Enclosed is my tax-deductible contribution to your campaign to outlaw driftnetting and protect marine life. \$15 \$25 \$50 \$100 or \$

NAME _____
 ADDRESS _____
 CITY _____ STATE _____ ZIP _____

Please make your check payable to Earth Island Institute Driftnet Campaign.

EARTH ISLAND INSTITUTE
 300 Broadway, San Francisco, California 94133

Monday
May 22, 1989

Seattle Post-Intelligencer

The voice of the Northwest since 1863

Editorials

Driftnet treaty not good enough

The U.S. Commerce Department should be applauded and the State Department taken to task for their positions on the pending driftnet fishing treaty with Japan. During a Senate Commerce Committee hearing, the two agencies clashed over whether the treaty should be signed. While a State Department official called it "an important first step," the Commerce representative told the panel it "falls way short of the mark."

We agree with the Commerce Department. The Japanese have been uncooperative with U.S. efforts to get North Pacific fishing regulated, refusing, as one example, to install transponders aboard boats that would allow their locations to be tracked by satellite. Even so, the United States has agreed to widen the

area in which Asian squid netters may operate. On any given day, 30,000 miles of squid nets can be out in the North Pacific. U.S. fishermen say some foreigners are illegally fishing for salmon destined for Washington, Oregon, and Alaska.

Sen. Slade Gorton, R-Wash., rightly noted that the treaty has "gone beyond asking the fox to guard the chicken coop. We've opened the door and promised not to watch."

Korea and Taiwan also use the huge squid nets to sweep the oceans of nearly all moving sea life, but they are not parties to the proposed agreement.

To end the unconscionable sweep-mining of the seas, much more than this feeble effort will have to be put forth by the administration. It's time to go back to the negotiating table.

Fish Mining on The Open Seas

The U.S. seeks a new deal with Japan to curb use of killer nets

The huge webs of strong nylon mesh, known as drift nets, can cover a slice of ocean up to 40 miles wide and 40 ft. deep. In North Pacific waters, fishermen from Japan, South Korea and Taiwan routinely let the nets float for as long as nine hours at night. They are intended to catch squid, but they also scoop up sea turtles, porpoises, seals, birds and various

by their nets. But after U.S. diplomats had worked out the arrangement, National Marine Fisheries Service officials declared it to be insufficiently stringent and called for revisions. Last week Commerce Secretary Robert Mosbacher told the State Department that the pact was unacceptable and would have to be renegotiated. Japan, however, is unwilling to reopen the negotiations. Japanese fishing officials point out that U.S. salmon fishermen use the same kind of drift nets that Asians do. The American versions, however, are many times smaller.

U.S. officials hope any final agreement reached with Japan will serve as a model for similar deals with Taiwan and South Korea. But they may resist U.S. pressure. Says T.F. Chen, a Taiwanese marine fisheries official: "We could never allow foreign representatives to board and inspect [our boats]. We can handle the enforcement ourselves." ■



A sea lion entangled in the nylon mesh

Intended for squid, they catch much more.

kinds of fish. Environmentalists call them killer nets and accuse those who use them of "strip-mining" the ocean.

Of particular concern to the U.S. and Canada is the damage inflicted by the nets on North Pacific stocks of sea trout and salmon. U.S. fishing-industry representatives claim that some Asian fishermen have been pulling large numbers of salmon out of nets intended for squid. As a result, they say, fewer young fish return to North American spawning streams.

A 1987 U.S. law called for international cooperation in monitoring catches on the open seas and enforcing fishing constraints. The U.S. and Japan later reached an agreement under which 32 U.S. observers would go aboard 460 Japanese squid-catching vessels to determine their fishing locations and count the number of sea creatures unintentionally killed

MARINE MAMMALS OF THE EASTERN NORTH PACIFIC

These species are keyed to the regions they are known to inhabit, although offshore species may wander into coastal waters and vice versa.

O = Offshore waters (continental slope and seaward)

C - Coastal (waters of continental shelf)

WC = British Columbia, Washington, Oregon, and California coasts

AK = Gulf of Alaska, Aleutians

BE = Bering Sea

This is not intended to be a comprehensive guide. If an animal does not seem to fit one of these species, consult the field manual (Leatherwood). Be as descriptive as possible, especially the first time a species is listed in your log.

The following species tend to be regularly confused:

Harbor porpoise - Dall's porpoise

Pacific white-sided dolphin - Dall's porpoise

Minke whale - beaked whale

Sei whale - fin whale

Northern fur seal - sea otter

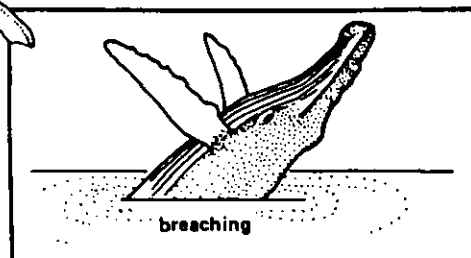
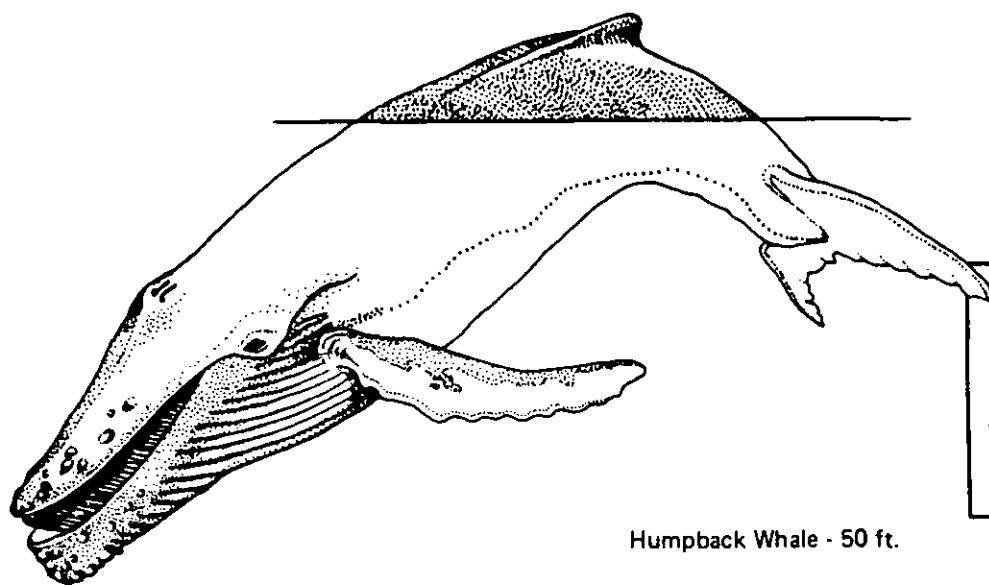
Often a fishing officer may be an experienced whaler. The English phonations of Japanese and Russian names of cetaceans are:

Humpback whale - Zato Kujira; Gorbach
 Grey whale - Koku Kujira; Seryy Kit
 Minke whale - Koiwashi Kujira; Malyy Polosatik
 Sperm whale - Makko Kujira; Kshalot
 Beaked whale - Akabo, Oogiha, Kobuha Kujira; Klyuvorylye Kit, Remnezub
 Giant Bottlenosed whale - Tsuchi Kujira; Severnyy Plavun
 Right whale - Semi Kujira; Yuzhnyy Kit
 Fin whale - Nagusu Kujira; Finval
 Sei whale - Iwashi Kujira; Seyval
 Blue whale - Shiro nagasu Kujira; Goluboy Kit
 Harbor porpoise - Nezumi iruka; Morskaya Svinya
 Pacific whitesided dolphin - Kama iruka; Tikhookeanskii Belobokiy Delfin
 Dall's porpoise - Ishi iruka; Belokrylaya Morskaya Svinya
 Killer whale - Shachi, Sakamata; Kosatka
 Grey grampus - Hana gondo Kujira; Seryy Delfin
 Northern right whale dolphin - Kiti semi iruka; Severnyy Kitovidnyy Delfin
 Pilot whale - Kobire gondo Kujira; Grinda

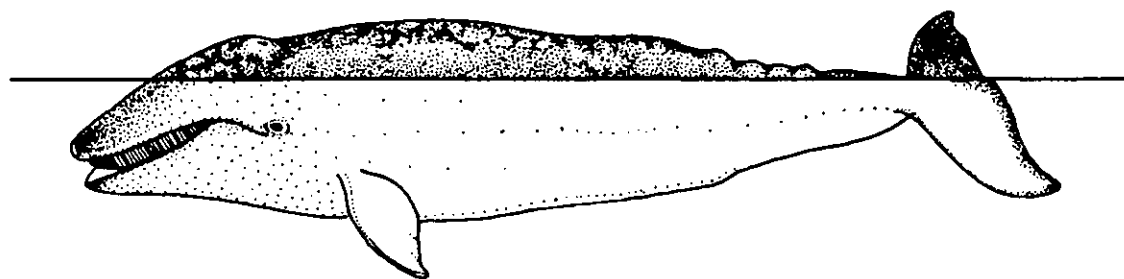
Note: There is often more than one common name in Japanese and Russian for a whale or dolphin. If you are told a different name, or if the above spelling is incorrect, please make note of both English and foreign names (Polish, Korean, Chinese, and German as well). Remember that identification by a whaler does not preclude the need for a detailed description.

LARGE WHALES

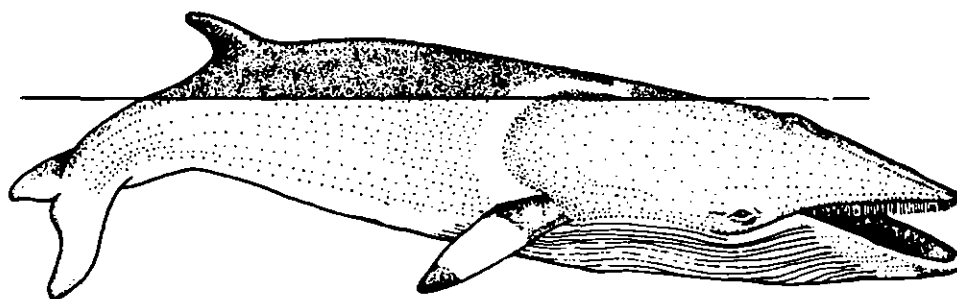
<u>Regions</u>	<u>Species</u>
O, C-WC, AK, BE	HUMPBAC WHALE (<u>Megaptera novaeangliae</u>) <ul style="list-style-type: none"> - thick body with long, narrow, knobby edged flippers. - coloring is black with white belly - underside of the flippers and flukes (tail) are usually white - when diving shows flukes which have irregular hind margin - arches back sharply when diving, small dorsal fin rests on dorsal hump - frequently leaps out of water, or slaps water with flippers - blow is mushroom shaped, 10-15 ft. tall
C-WC, AK, BE	GREY WHALE (<u>Eschrichtius robustus</u>) <ul style="list-style-type: none"> - coloring is gray with distinct white mottling - often has barnacle spots on body - many small humps behind the low dorsal hump (no dorsal fin) - tail is usually shown when diving - blow is usually low and bushy
O,C-WC, AK, BE	MINKE WHALE (<u>Balaenoptera acutorostrata</u>) <ul style="list-style-type: none"> - small, with a distinctly recurved dorsal fin - dark grey-brown body and white belly - distinctive white band across flipper - light patch (chevron) between head and dorsal fin - barely visible blow and flukes not raised when diving - head is very pointed (V-shaped), visible back is very rounded - appearance similar to beaked whales



Humpback Whale - 50 ft.



Grey Whale - 45 ft.



Minke Whale - 30 ft.

Note: Drawings are not to scale

LARGE WHALES

RegionsSpecies

O, C-WC, AK, BE

FIN WHALE (Balaenoptera physalus)

- greyish-brown body and white belly
- blow is tall and cone shaped
- distinct, recurved dorsal fin (rounded at top)
- lower right lip is white
- blow appears before dorsal fin is seen

O, C-WC, AK, BE

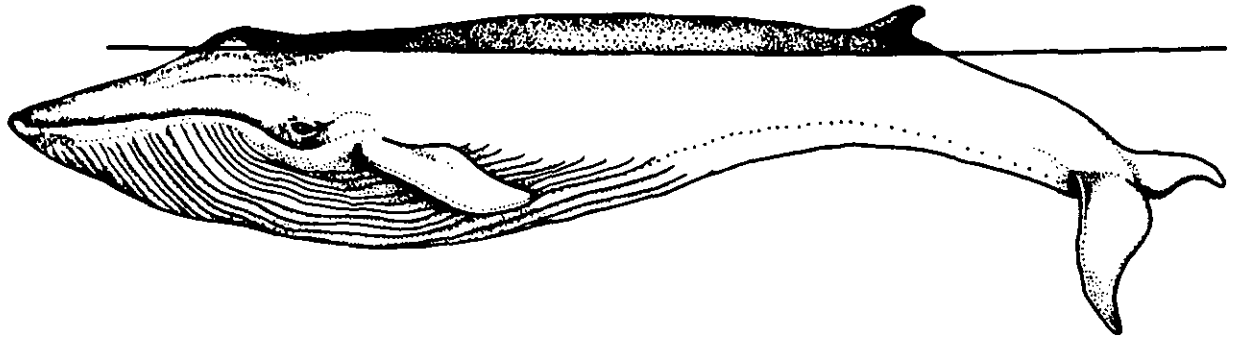
SEI WHALE (Balaenoptera borealis)

- dark steel grey or bluish grey, often appears galvanized from scars
- cone shaped blow
- distinct, recurved dorsal fin (pointed at top)
- blow and dorsal fin often appear at same time

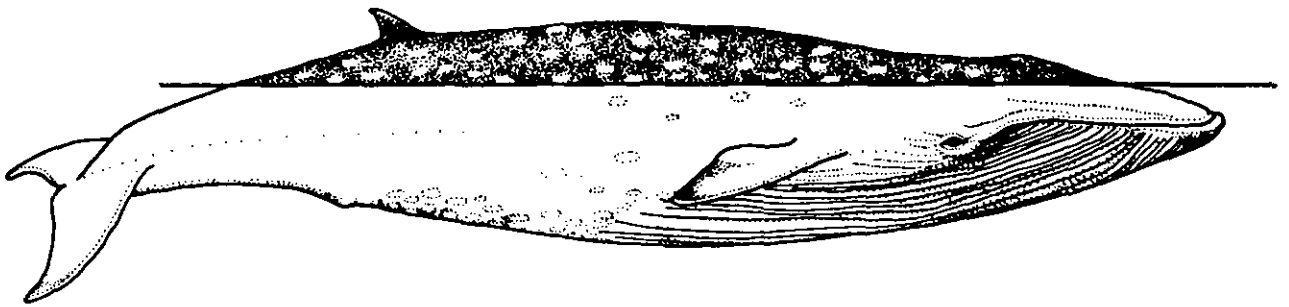
O, C-WC, AK

BLUE WHALE (Balaenoptera musculus)

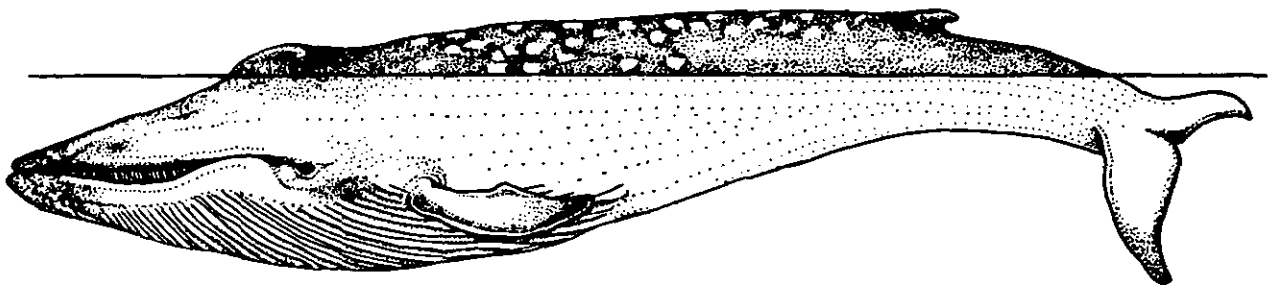
- broad, low and flat snout with bulging blowholes (larger than fin & sei)
- bluish grey with light blue metallic mottling
- very small nub-shaped dorsal fin located well back
- high vertical blow (also cone shaped) (20 ft)



Fin Whale - 60-70 ft.



Sei Whale - 50-60 ft.



Blue Whale - 70-80 ft.

Note: Drawings are not to scale

LARGE WHALES

RegionsSpecies

O-WC, AK

SPERM WHALE (Physeter macrocephalus)

- large, box-like head with blow hole on the left side
- blow leans forward (about 45°) and flukes raised on final dive
- dark brownish-grey body with shriveled appearance behind neck
- short triangular dorsal hump followed by series of ridges

O-WC, AK, BE

BEAKED WHALE (Ziphius and Mesoplodon sp.)

- body is spindle shaped with small head and narrow tail stock
- prominent beak, often with light pigmentation
- light to extensive scarring often widest on back
- blow is low and inconspicuous
- animals shy, usually dive on approach and are not re-sighted
- dorsal fin small and recurved

O-WC, AK, BE

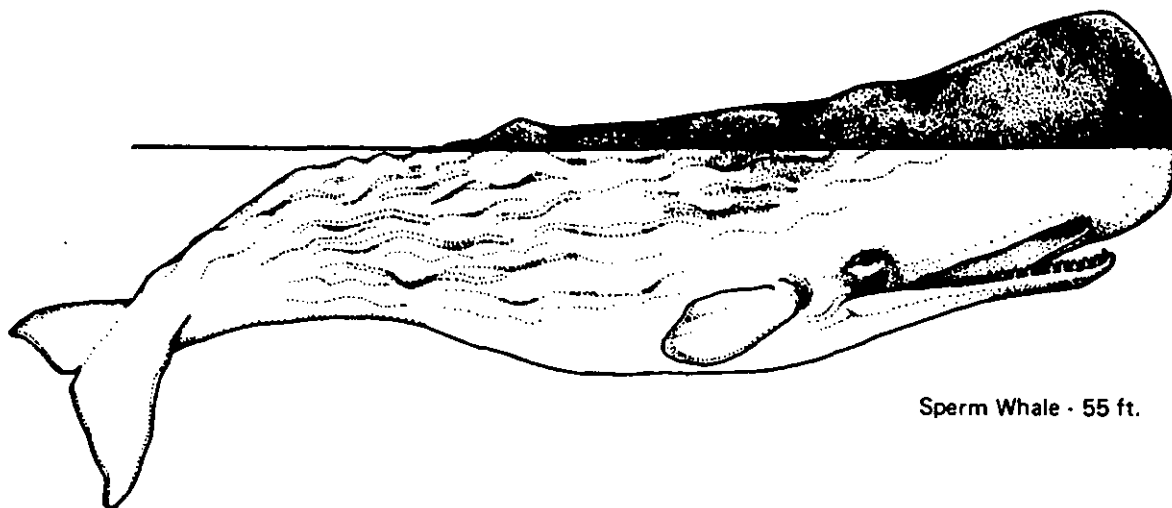
GIANT BOTTLENOSE WHALE (Baird's beaked whale) (Berardius bairdi)

- prominent, bulbous forehead with a long, cylindrical beak
- grey to brown color with extensive scarring
- dorsal fin nearly triangular, sits well back

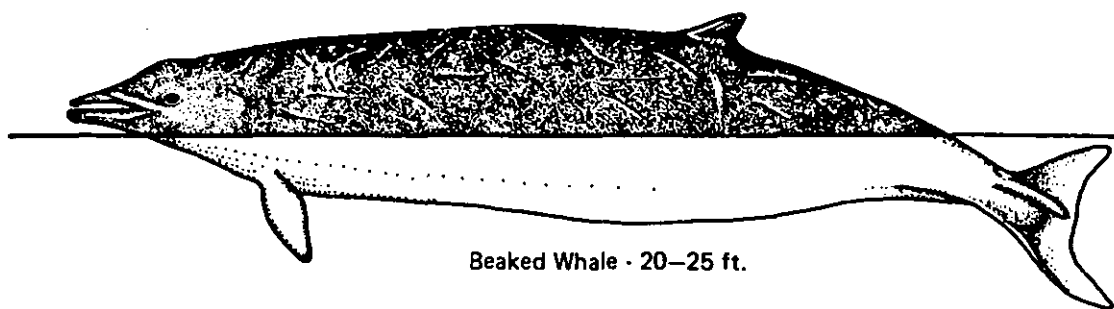
O, C-WC, AK

RIGHT WHALE (Balaena glacialis)

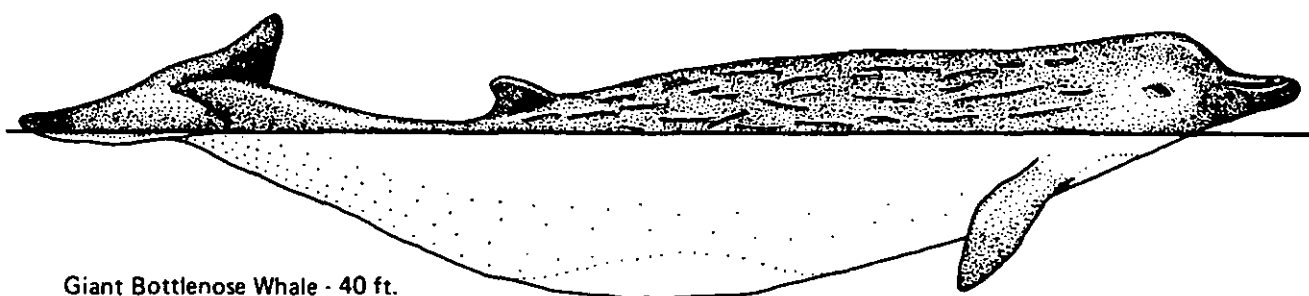
- huge head with arched jaws
- shiny black body with no dorsal fin (smooth back)
- whitish bumps (callosities) on top of head
- blow is distinctly V-shaped



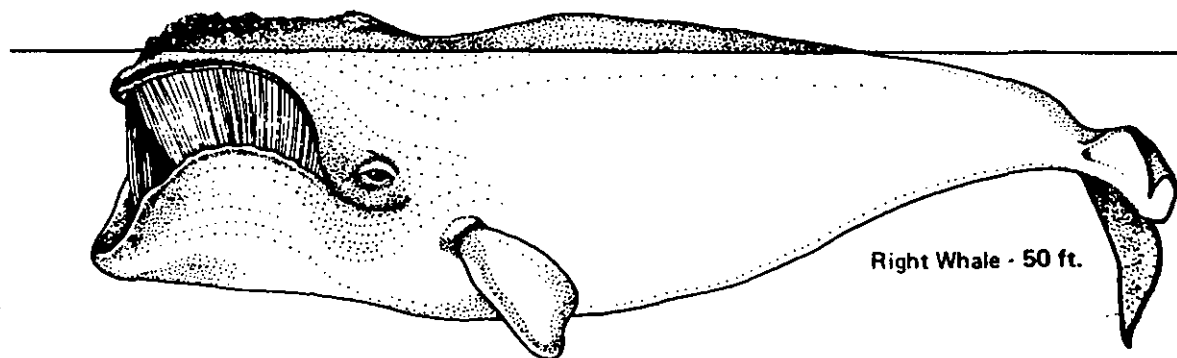
Sperm Whale - 55 ft.



Beaked Whale - 20-25 ft.



Giant Bottlenose Whale - 40 ft.



Right Whale - 50 ft.

Note: Drawings are not to scale

100

SMALL WHALES AND DOLPHINS

Regions

Species

O, C-WC, AK, BE

KILLER WHALE (orcinus orca)

- black with white eye patch, saddle patch (behind fin), and belly
- dorsal fin very tall in males, smaller in females and young
- often travel in family pods

O, C-WC

GREY GRAMPUS (Grampus griseus)

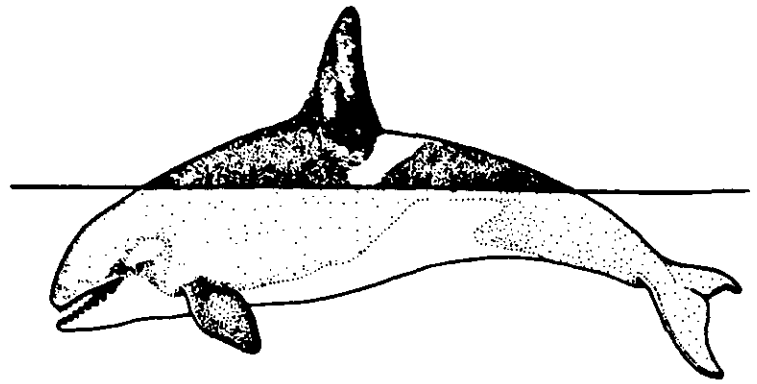
- grey with extensive scarring on body, may appear almost white
- tall, recurved dorsal fin (like female killer whale)
- head is blunt with crease, or fold in forehead
- travel in small groups

O, C-WC

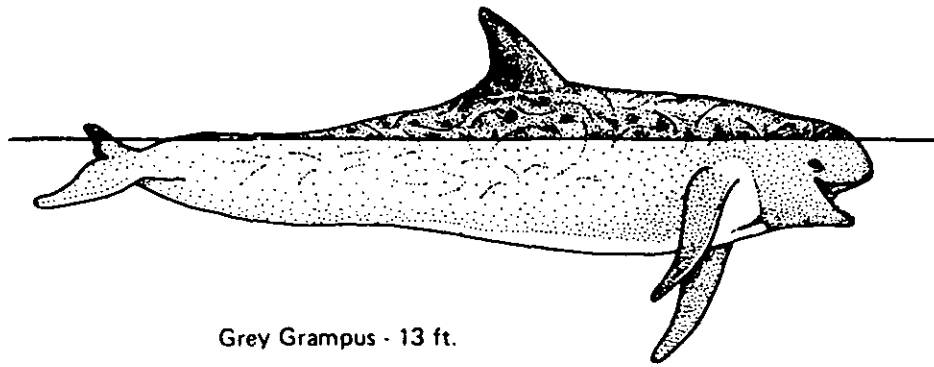
PILOT WHALE (BLACKFISH) (Globicephala macrorhynchus)

- body is dark brown to black
- thick, bulbous forehead
- dorsal fin is forward on back, very broad based and recurved

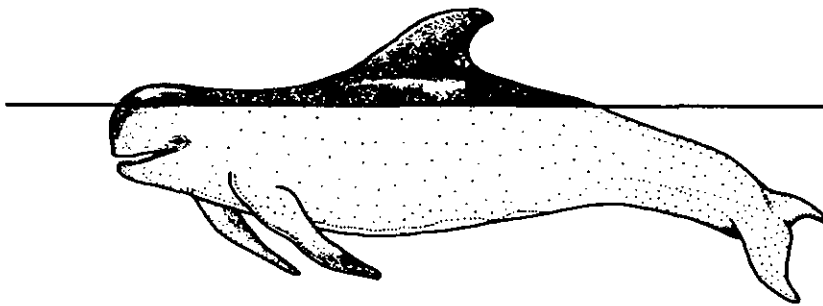
Killer Whale - 30 ft.



Grey Grampus - 13 ft.



Pilot Whale - 20 ft.



Note: Drawings are not to scale

SMALL WHALES AND DOLPHINS

RegionsSpecies

C-WC, AK, BE

HARBOR PORPOISE (Phocoena phocoena)

- coloring is dark brown or grey above, light grey below
- dorsal fin is low and triangular with a blunt tip
- usually seen in pairs or small groups - do not approach boats
- movement is jerky roll; rarely roostertail or leap clear of water

O, C-WC, AK

PACIFIC WHITE SIDED DOLPHIN (Lagenorhynchus obliquidens)

- grey with white belly and whitish bands along the sides
- dorsal fin tall and sharply recurved, grey in front, white aft
- often seen leaping in large groups, occasionally roostertail

O, C-WC, AK, BE

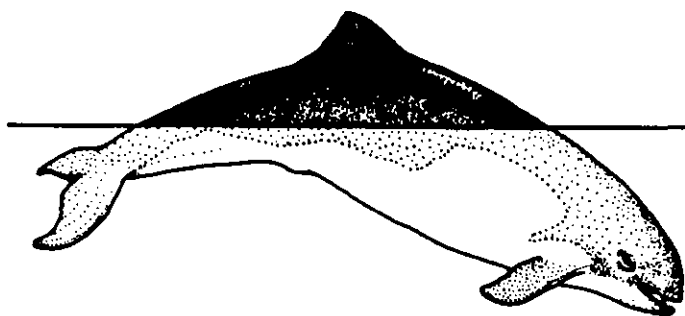
DALL'S PORPOISE (Phocoenoides dalli)

- black body with white flanks, white on upper dorsal fin and edge of flukes
- rarely jumps clear of water, most often seen "roostertailing"
- fond of bow-riding (look for color variations if seen close)
- resembles harbor porpoise when moving slowly

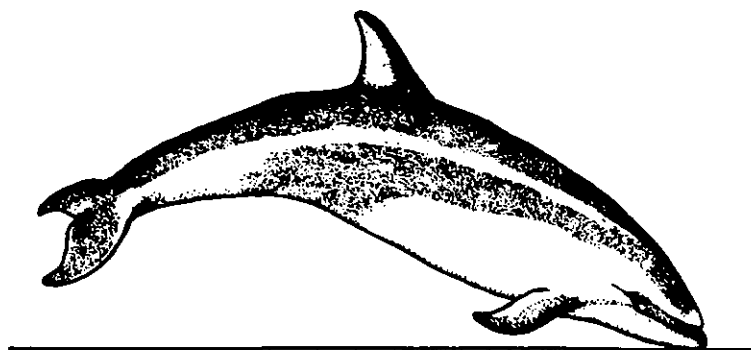
O, C-WC

NORTHERN RIGHT WHALE DOLPHIN (Lissodelphis borealis)

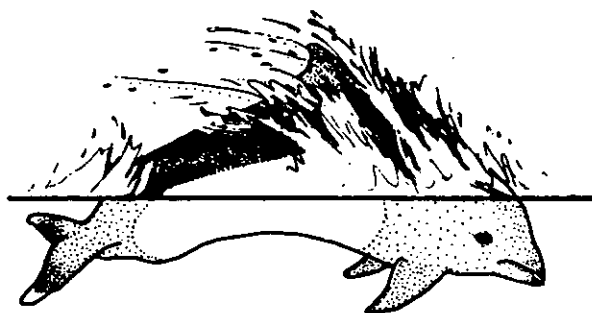
- jet black with white belly
- no dorsal fin, appear as slender cigars when porpoising in large groups
- often sighted with Pacific white sided dolphins, in large (>100) groups



Harbor Porpoise - 5 ft.

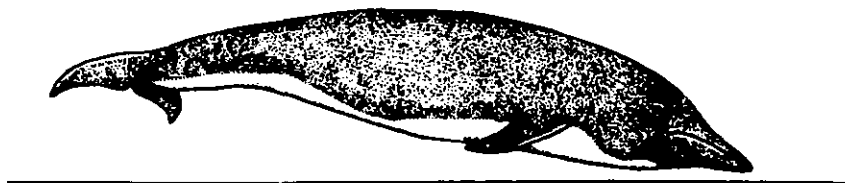


Pacific White Sided Dolphin - 8 ft.

















Dall's Porpoise - 6 ft.

Northern Right-Whale Dolphin - 9 ft.

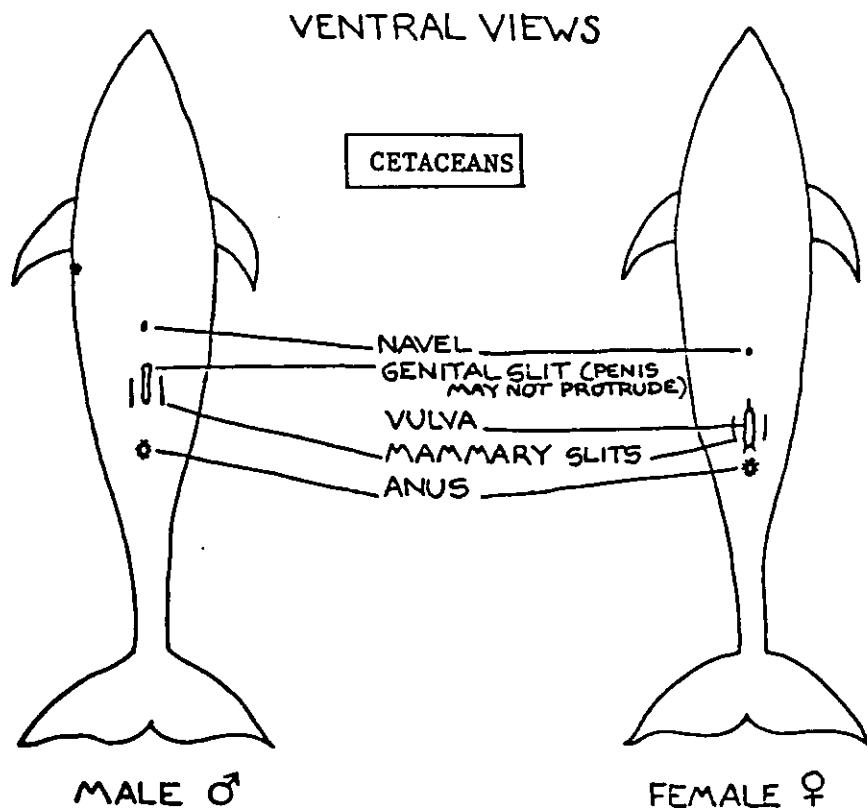
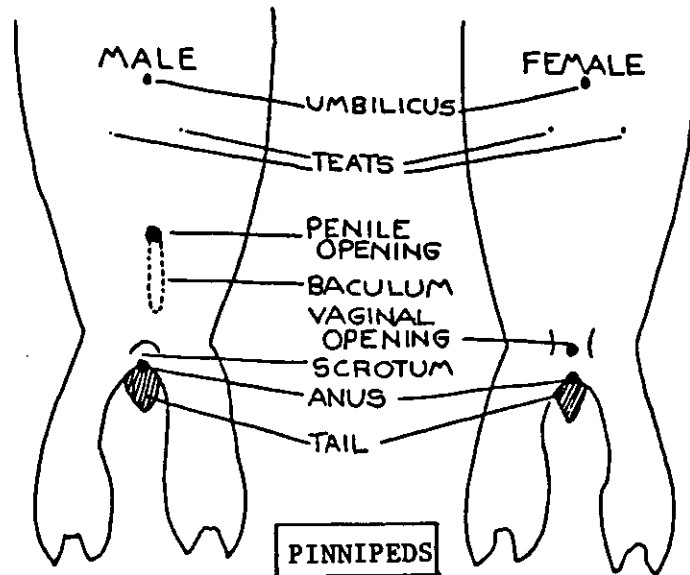


Note: Drawings are not to scale

Table 1.—*Blowing and diving characteristics of some of the large whales (reproduced by permission from Gordon C. Pike, Guide to the Whales, Porpoises and Dolphins of the North-East Pacific and Arctic Waters of Canada and Alaska)*

Surfacing and blowing	Beginning the dive	Diving
	Blue	
	Finback	
	Sei	
	Humpback	
	Gray	
	Right	
	Sperm	

SOME MORPHOLOGICAL DIFFERENCES BETWEEN MALE AND FEMALE PINNIPEDS AND CETACEANS



THE DISTANCE BETWEEN THE ANUS AND THE GENITALS IS GREATER IN MALES; OTHERWISE THE SEXES APPEAR SIMILAR BECAUSE MALES HAVE EXTERNAL TEATS, AND FEMALES HAVE ENLARGED CLITORI. IF POSSIBLE, TAKE A PHOTOGRAPH OR MAKE A DRAWING.

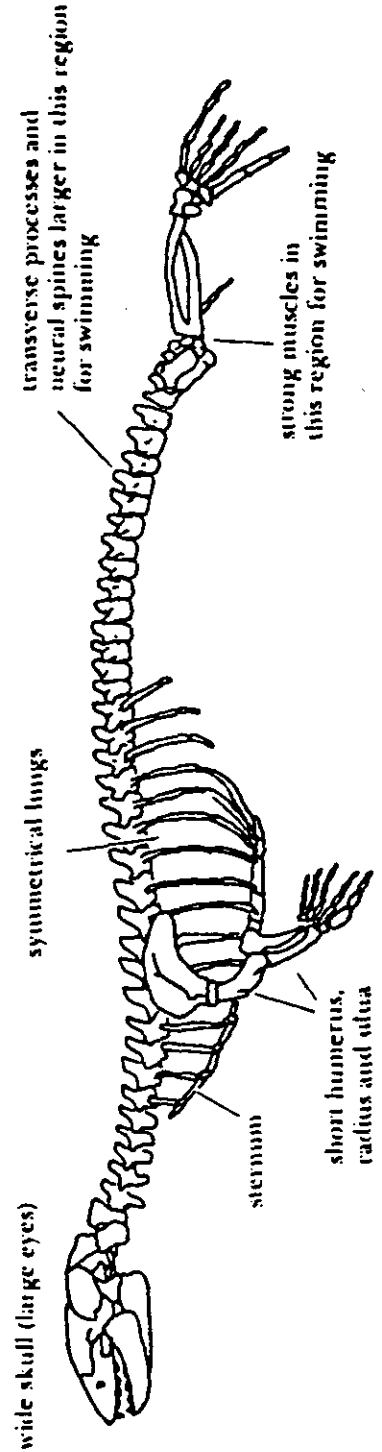
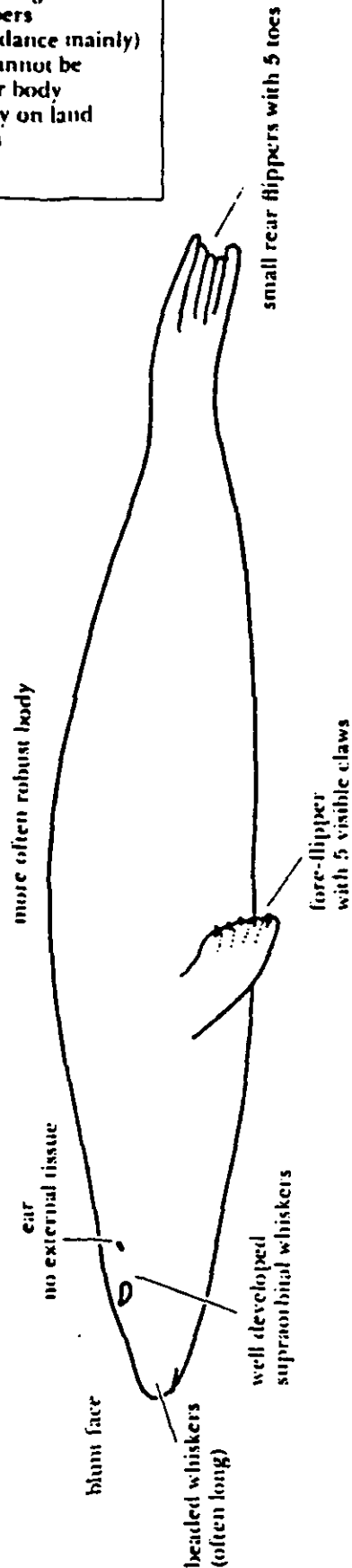
TRUE SEALS	SEA LIONS/FUR SEALS
No external ears	External ears
Small foreflippers for guidance only	Large foreflippers - 1/4 of body length; used for power, guidance, walking
Flippers fully furred	Flippers partially furred
Hind flippers cannot be turned under body	Hindflippers long, can be turned under body
Five claws on all flippers	No claws on foreflippers, three on hindflippers
Pelage varies in color	Pelage uniformly colored
Whiskers beaded	Whiskers uniform
Testes internal	Testes scrotal

Anatomy of Typical True Seal

(Phocidae)

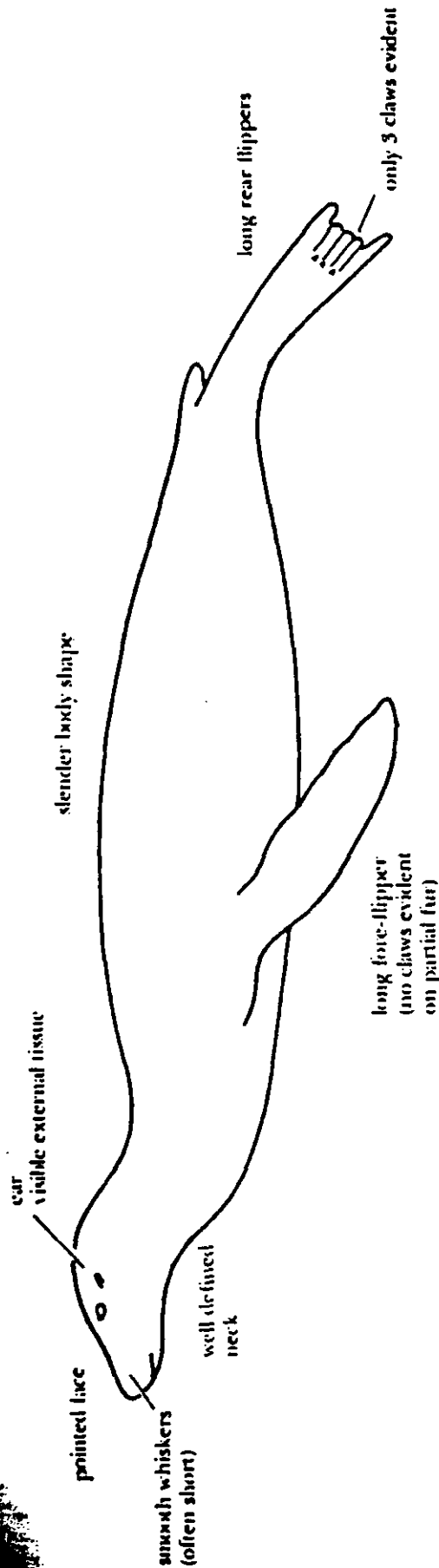
PHOCIDAE: (HAIR SEALS)

- no external cartilaginous ears
- small fore-flippers
(used for guidance mainly)
- hind flippers cannot be turned under body
- slow and clumsy on land
- breeding varies
- furred flippers



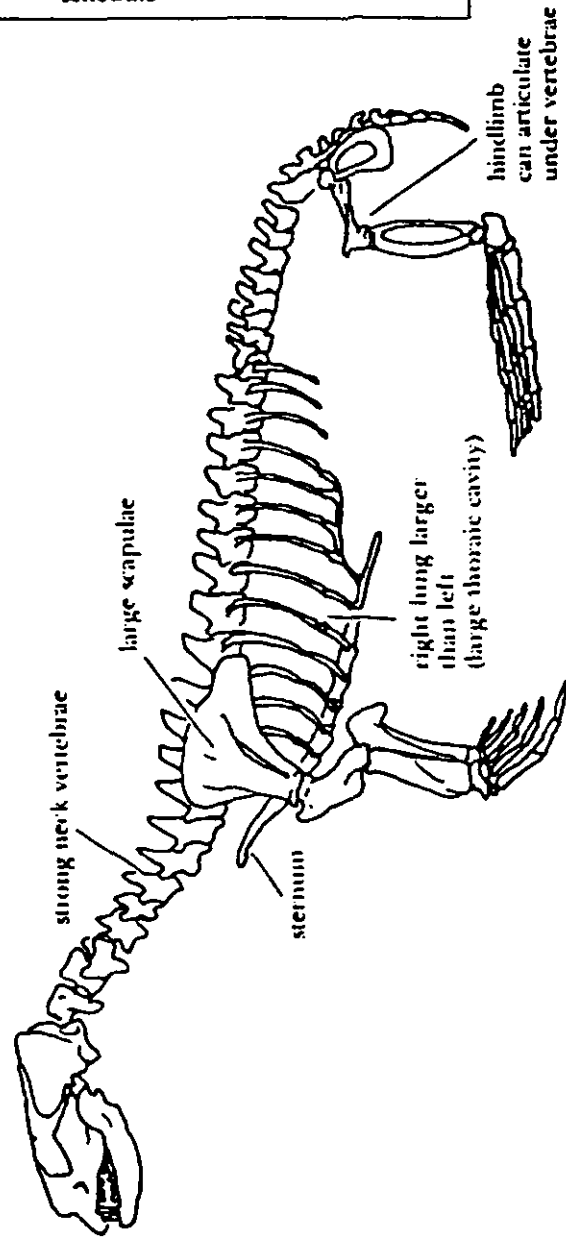
Anatomy of Typical Fur Seal or Sea Lion

(Otariidae)



OTARIIDAE: (FUR SEALS)

- visible cartilaginous ears
- large fore-flippers which seal can stand on. Used for swimming and steering only partly furred
- hind flippers long and can be turned underneath body to walk on land
- well defined rookeries and breeding schedule



SEA LIONS / FUR SEALS

RegionsSpecies

C-WC
AK
BE

Steller or Northern Sea Lion
(Eumetopias jubatus)

- males to 12 ft. and 2,000 lbs.,
females to 7 ft. and 600 lbs.
- males are generally light brown, darker on the chest and abdomen, females are comparatively lighter
- adult males have thick mane covering massive neck
- snout not as pointed as California sea lion's
- often associated with fishing vessels

C-WC

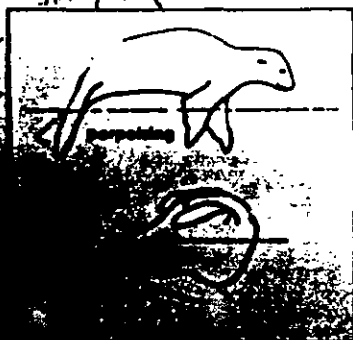
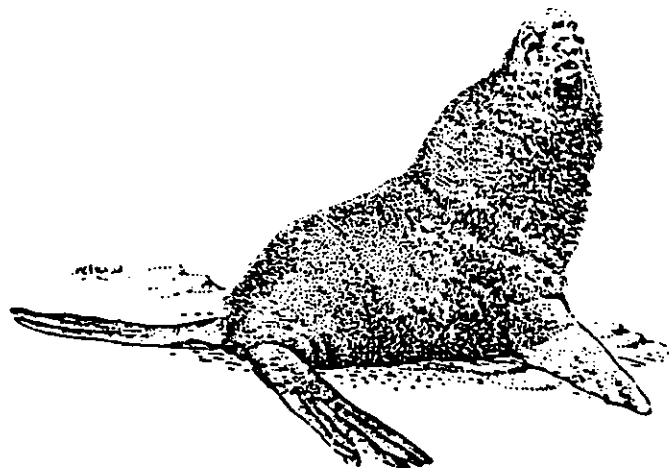
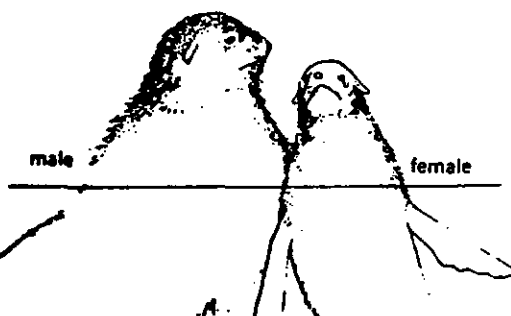
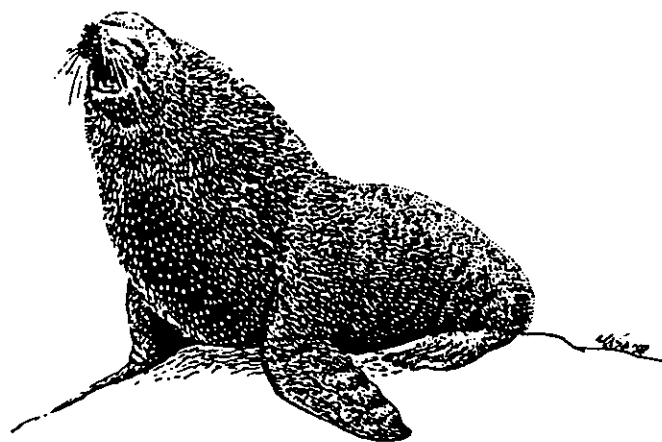
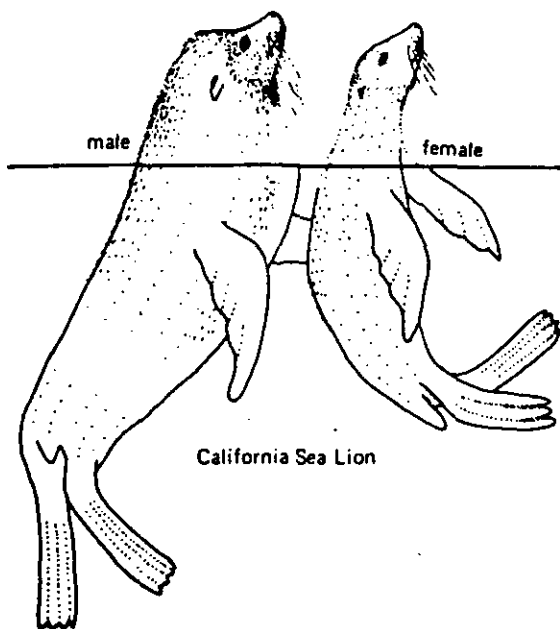
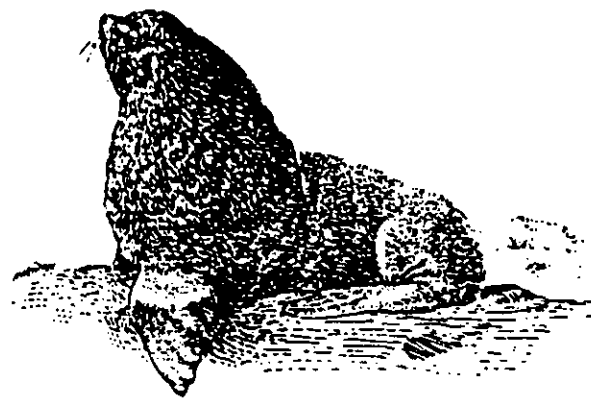
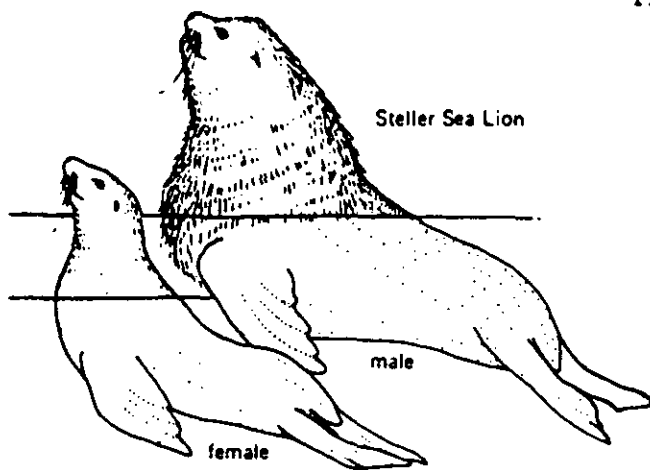
California Sea Lion
(Zalophus californianus)

- males to 7 ft. and 800 lbs.,
females to 6 ft. and 200 lbs.
- males are dark brown, dotted with lighter areas, females are lighter in color with darker areas on the throat and neck
- males have a high sagittal crest on head

O
C-WC
AK
BE

Northern or Alaska Fur Seal
(Callorhinus ursinus)

- males to 8 ft. and 600 lbs.,
females to 5 ft. and 150 lbs.
- fur is dark brown or dark gray on the back and lighter on the underside; silvery chest on juveniles
- very pointed snout, triangular face, and white whiskers (adults)
- may "porpoise" through water when alarmed or playing



Drawings are not to scale

SEALS AND SEA OTTER

RegionsSpecies

C-WC

Northern Elephant Seal(Mirounga angustirostris)

- males to 15 ft. and 4,000 lbs,
- females to 9 ft. and 700 lbs.
- color is dirty grey
- males have long, inflatable snout

C-WC

Harbor Seal

AK

(Phoca vitulina)

BE

- 4 to 5 ft., 150 to 200 lbs.
- light colored fur with dark and light spotting
- snout, eyes, and top of head often only parts seen while swimming at sea

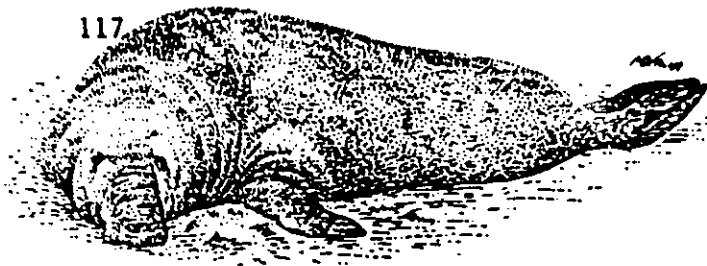
C-WC

Sea Otter

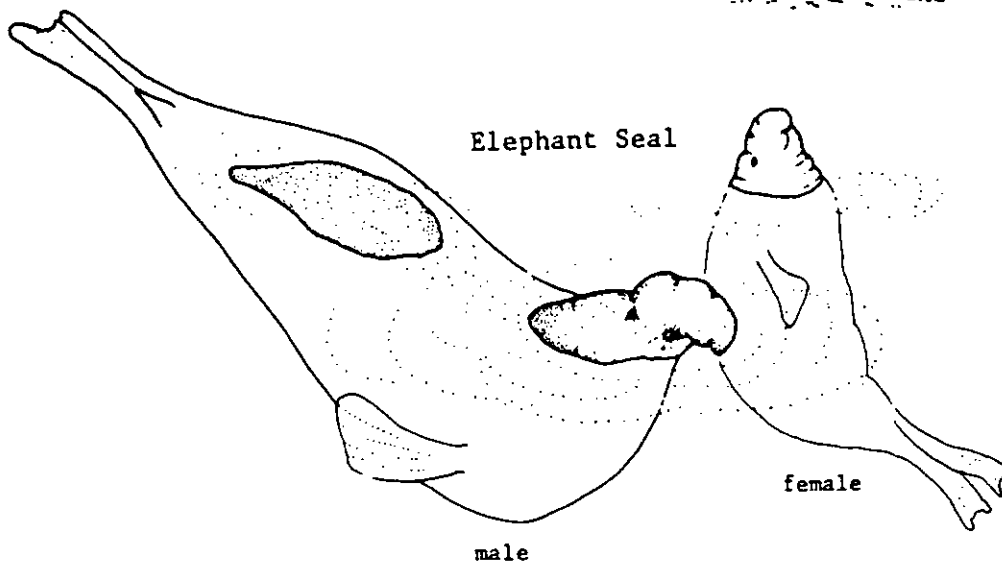
AK

(Enhydra lutris)

- 4 to 5 ft., 50 to 80 lbs.
- dark brown fur with light colored face
- most often seen floating on back
- inhabits shallow coastal areas, especially near kelp beds

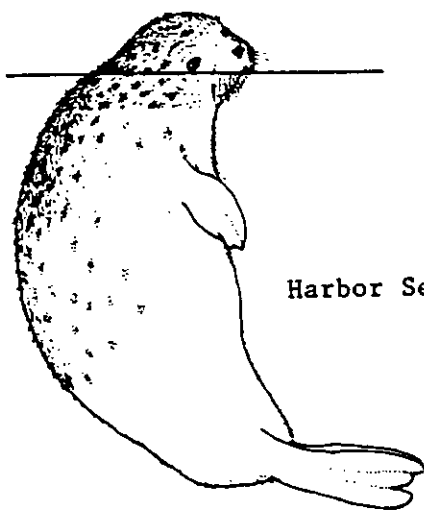


Elephant Seal

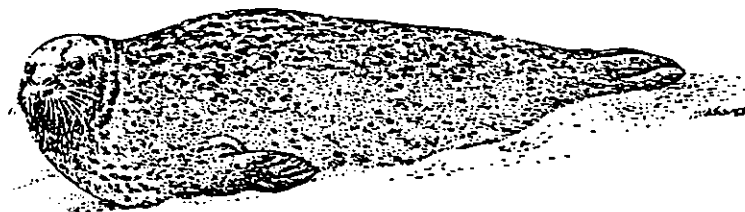


male

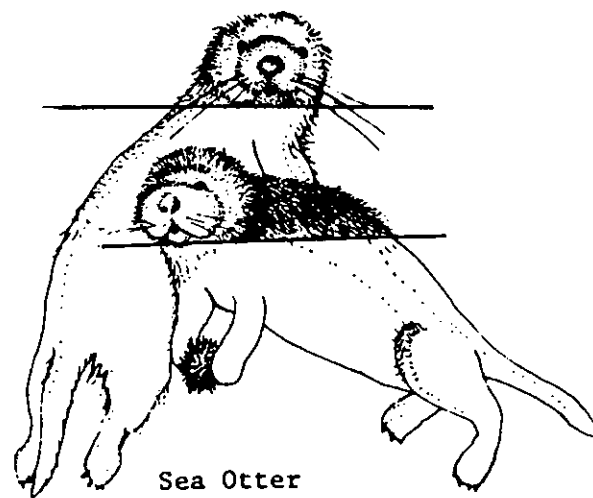
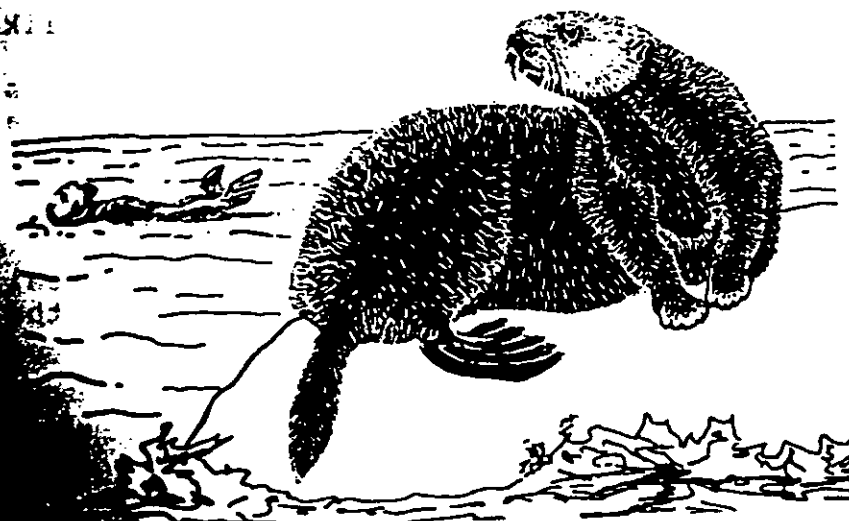
female



Harbor Seal



XII



Sea Otter

Note: Drawings are not to scale

WALRUS AND ICE SEALSRegionsSpeciesC
BEWalrus(Odobenus rosmarus)

- males to 14 ft. and 3,500 lbs., females to 12 ft. and 2,000 lbs.
- body is bulky and heavy and the head is comparatively small
- snout is blunt with large array of whiskers on upper lip
- both sexes have large white tusks

C
BEBearded Seal(Eringathus barbatus)

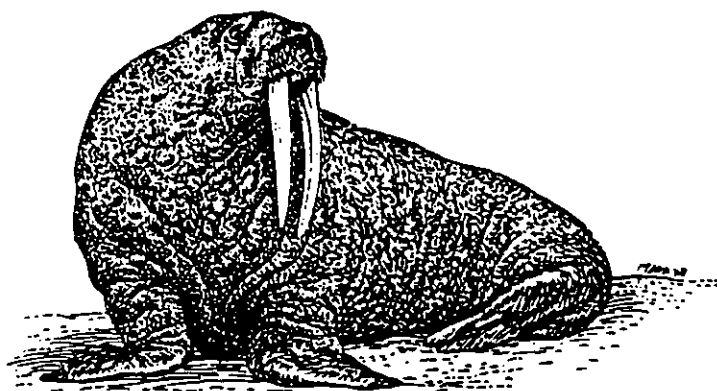
- males to 9 ft. and 850 lbs., females are only slightly smaller
- uniform brownish gray in color
- the head is disproportionately small as compared to the body
- forehead is protruded, snout is wide with characteristic, long, thick whiskers

C
BERinged Seal(Pusa hispida)

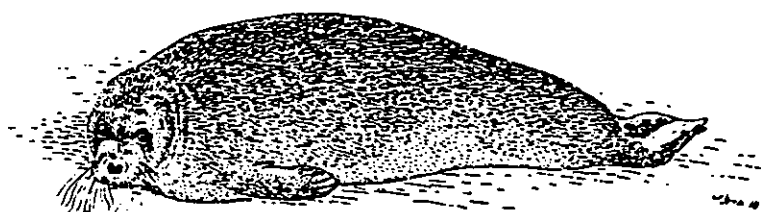
- males 3 - 4 ft. and 140 - 180 lbs., females are only slightly smaller
- body is dark brownish gray on the back and whitish on the underside. There are jet black or slightly grayish irregular spots surrounded by ring-shaped lighter marks on the back and sides of the body but not on the underside.
- Pups are born with embryonal white pelage, but they molt one or two weeks after birth.

C
BERibbon Seal(Histriophoca fasciata)

- males 4 - 5 ft. and 150 - 200 lbs., females are only slightly smaller
- Male coloration is dark (gray with blue and purple mixed). There is a wide, light colored, necklace-like band around the crown of the head extending to the front of the neck, and there are other circular bands around each of the forelimbs. Two bands are joined at the anus and extend upward around the posterior end of the body.
- Female coloration is dark beige or brownish gray all over with an even darker back and forelimbs. The banding is not as obvious in females or immature seal
- Pups are born with an embryonal white pelage, but they molt two to four weeks later.



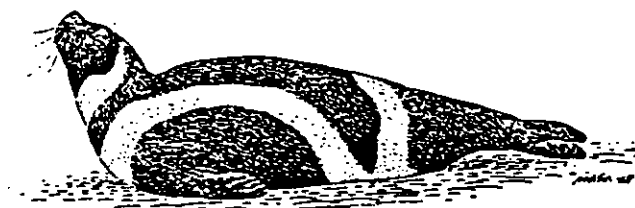
Walrus



Bearded Seal



Ringed Seal

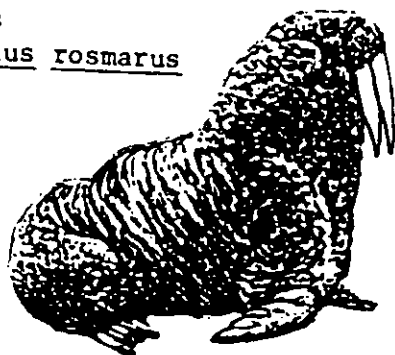


Ribbon Seal (Male)

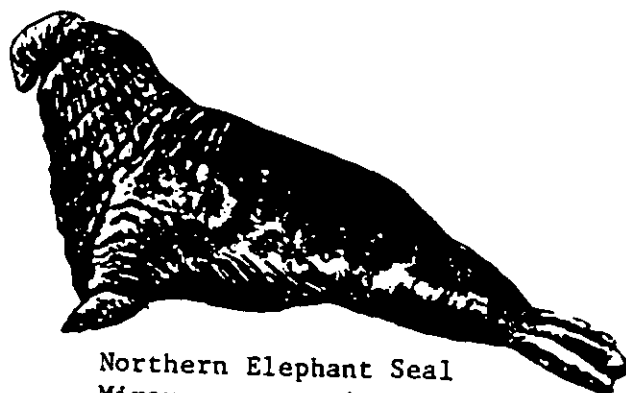
Note: Drawings are not to scale

SIZE COMPARISONS OF NORTHEAST PACIFIC PINNIPEDS AND SEA OTTER

Walrus
Odobenus rosmarus



Northern Elephant Seal
Mirounga angustirostris



California Sea Lion
Zalophus californianus



Steller Sea Lion
Eumetopias jubatus
(Male and Female)



Bearded Seal
Erignathus barbatus



Northern Fur Seal
Callorhinus ursinus
(Male and Female)



Ringed Seal
Phoca hispida



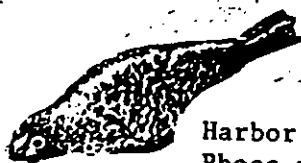
Sea Otter
Enhydra lutris








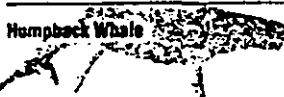







Ribbon Seal
Phoca fasciata



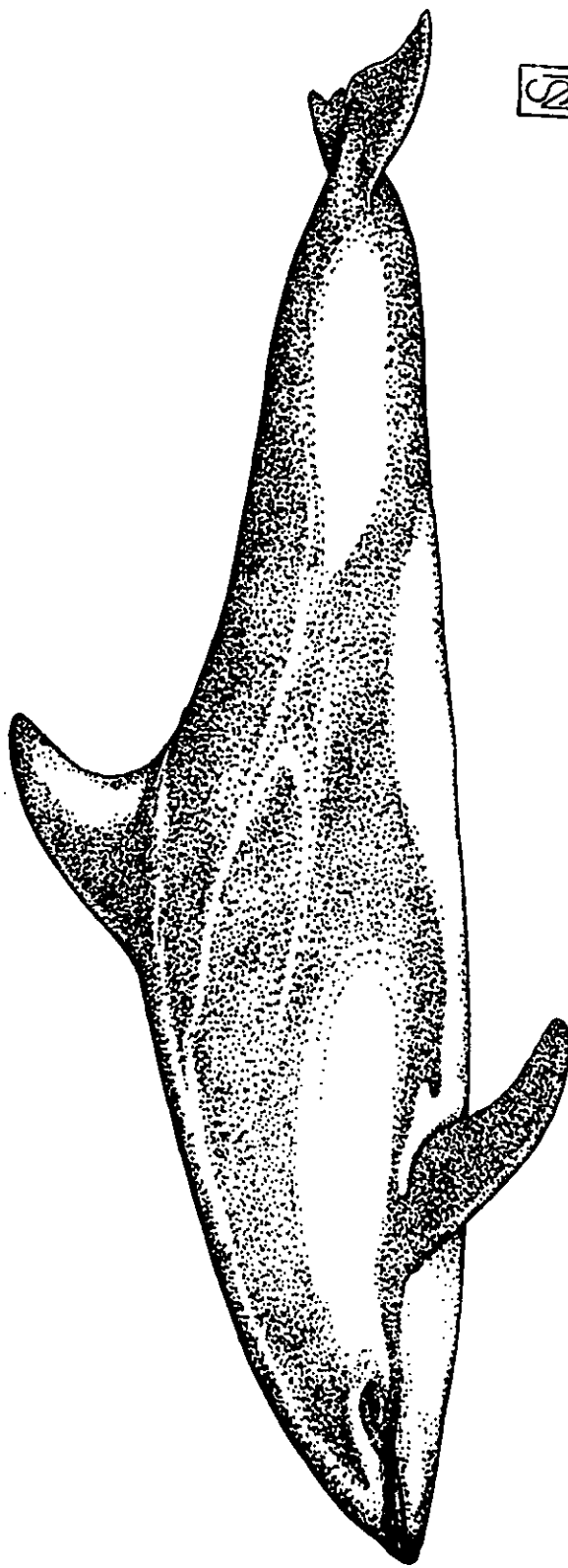
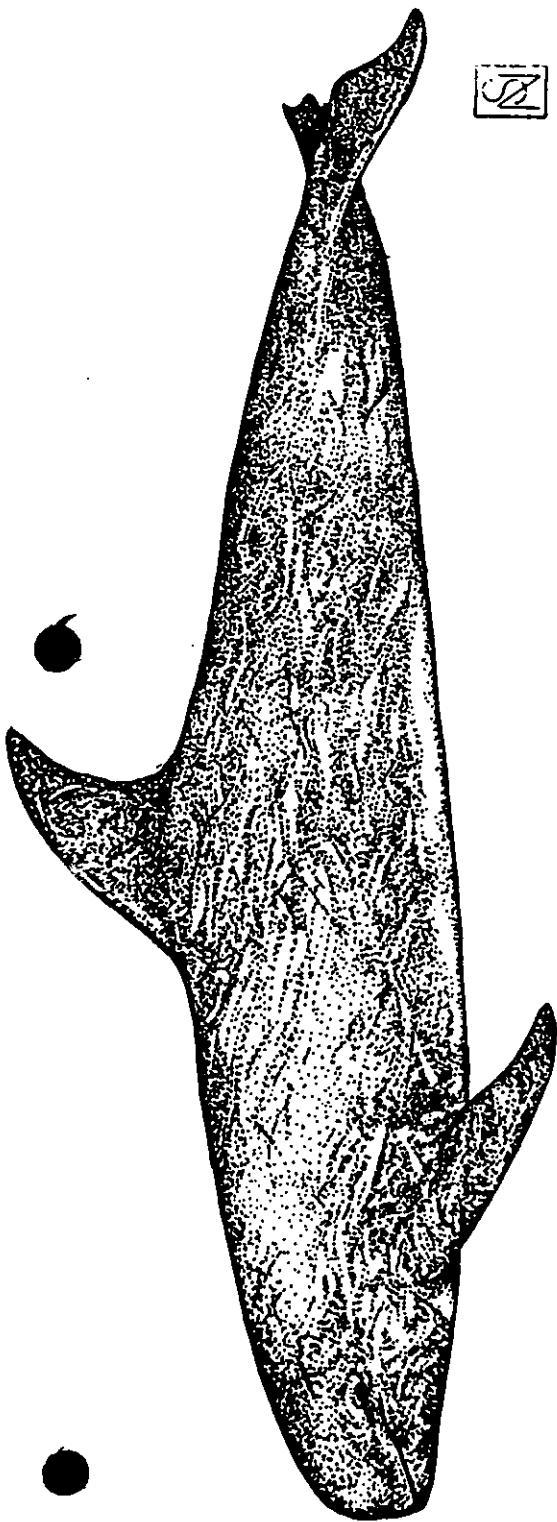
Harbor Seal
Phoca vitulina



Marine Mammal Life History Notes

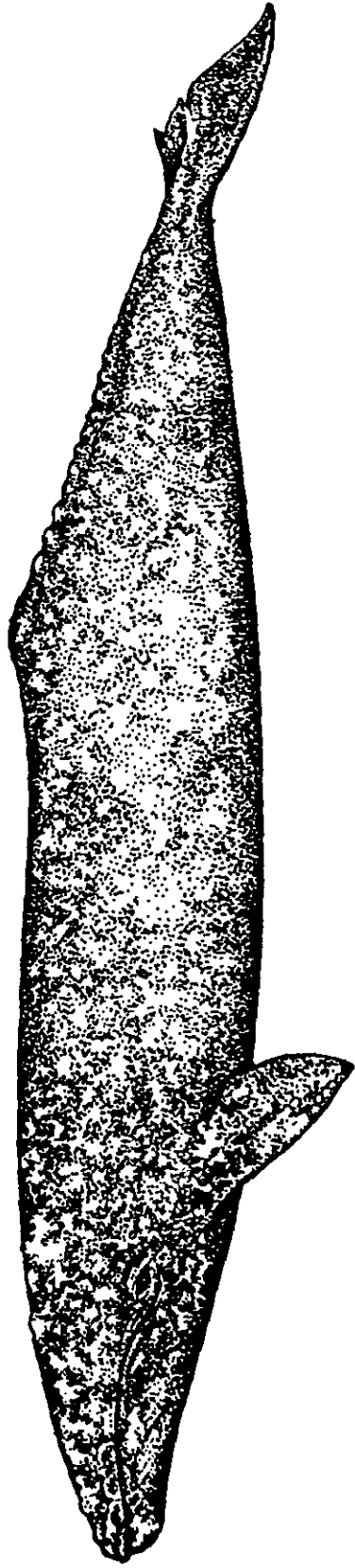
		Adult Length/Weight		Newborn Length/Weight		Life Span	Age at Sexual Maturity	Breeding and Reproduction	Characteristic Color
		m	kg	m	kg				
Harbor Seal		1.8 ♂ 1.2 ♀	105 45	0.8	10	30	6 ♂ 6 ♀	Monogamous: Gestation 8-9 mos. delayed implantation. 2-3 mos. : 1 birth/year	Gray-brown with dark rings and spots. Dark brown at birth.
Elephant Seal		5.0 ♂ 3.0 ♀	2,000 800	1.2	25	20	7-10 ♂ 3-4 ♀	Polygynous. Breed in California-Mexico. December-February; Gestation 11 mos.; 1 birth/year	Brown. Black at birth changing to gray in first month.
Northern Sea Lion		3.2 ♂ 2.2 ♀	1,000 300	1.0	20	20	5 ♂ 3-5 ♀	Polygynous; Breed in North Pacific Islands. May-July; Gestation 11 mos. delayed implantation. 3-5 mos. : 1 birth/year	Dark brown at birth changing to tan by autumn.
California Sea Lion		2.5 ♂ 1.6 ♀	365 115	0.8	10	20	5 ♂ 5 ♀	Polygynous; Breed in California-Mexico. May-June. Gestation 11 mos.; 1 birth/year	Dark brown
Minke Whale		9.0 ♂ 9.0 ♀	9,000 9,000	2.8	250		8 ♂ 8 ♀	Breed June-August. Gestation 10 mos.; 1 birth/year	Black with gray streaks, white shoulder band.
Humpback Whale		16.0 ♂ 16.5 ♀	60,000 62,000	4.3	800	30-50	8 ♂ 8-9 ♀	Breed off Hawaii and Mexico. January-February; Gestation 11 mos. : 1 birth every 2-3 years	Black with white belly, often with extensive white on flippers.
Gray Whale		13.0 ♂ 14.0 ♀	30,000 32,000	4.5	500	30-70	8 ♂ 8 ♀	Breed off Baja California. January-February; Gestation 13.5 mos. : 1 birth every 2-3 years	Gray with white and yellow patches of barnacles and whale lice
Killer Whale		9.1 ♂ 8.2 ♀	5,000 3,000	2.4	180	40+	8 ♂ 8 ♀	Gestation 15 mos. : 1 birth every 3 years	Black with white belly, eye patch, and flanks, and gray saddle behind dorsal fin
Pacific White-sided Dolphin		2.2 ♂ 2.2 ♀	90 90	1.2	25		5 ♂ 5 ♀	Breed spring-fall; Gestation 10-12 mos.	Black with white streaks, shoulder, and belly
Short-finned Pilot Whale		6.9 ♂ 5.0 ♀	1,200 800	1.4		40-50	12 ♂ 6 ♀	Breed year round; Gestation 14.5 mos.; 1 birth every 3 years	Black with grayish saddle and white patch on belly
Memo's Dolphin		4.0 ♂ 4.0 ♀	500 500					Breeding/reproduction information unknown	Dark gray with white spots and patches
Finless Porpoise		1.8 ♂ 1.8 ♀	72 72	0.8	10		3-4 ♂ 3-4 ♀	Gestation 11 mos.; 1 birth/year	Gray to black backs with white bellies
Black Porpoise		2.0 ♂ 1.9 ♀	150 150	1.0	16	22+	8 ♂ 7 ♀	Gestation 11 mos.; 1 birth every 3 years	Jet black with white patch on flanks

From: Birds and Mammals of Puget Sound by Angell & Balcomb

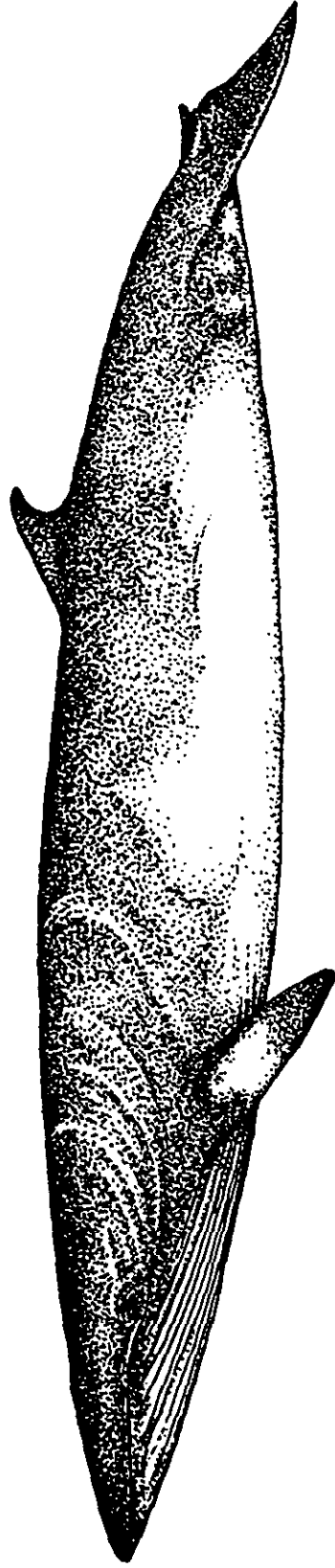


S. NOEL 3-14-86
 Pac. Co. Biological Station, Chalky

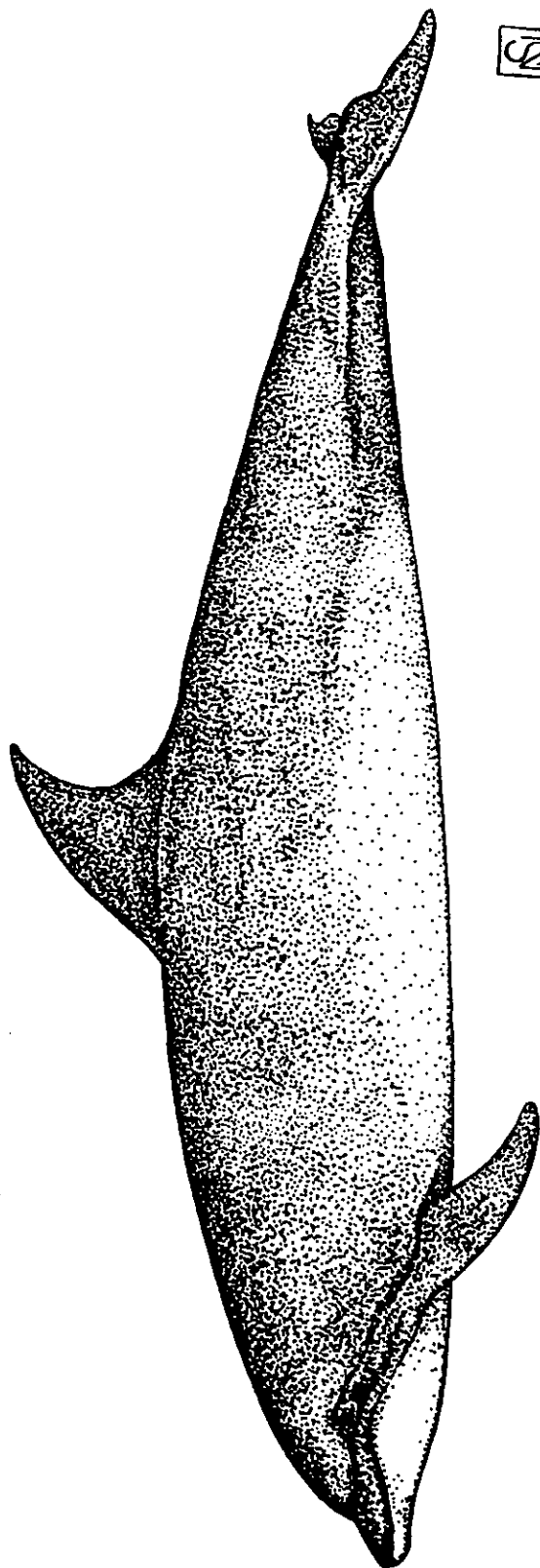
Grey whale
S. noel



Mink whale

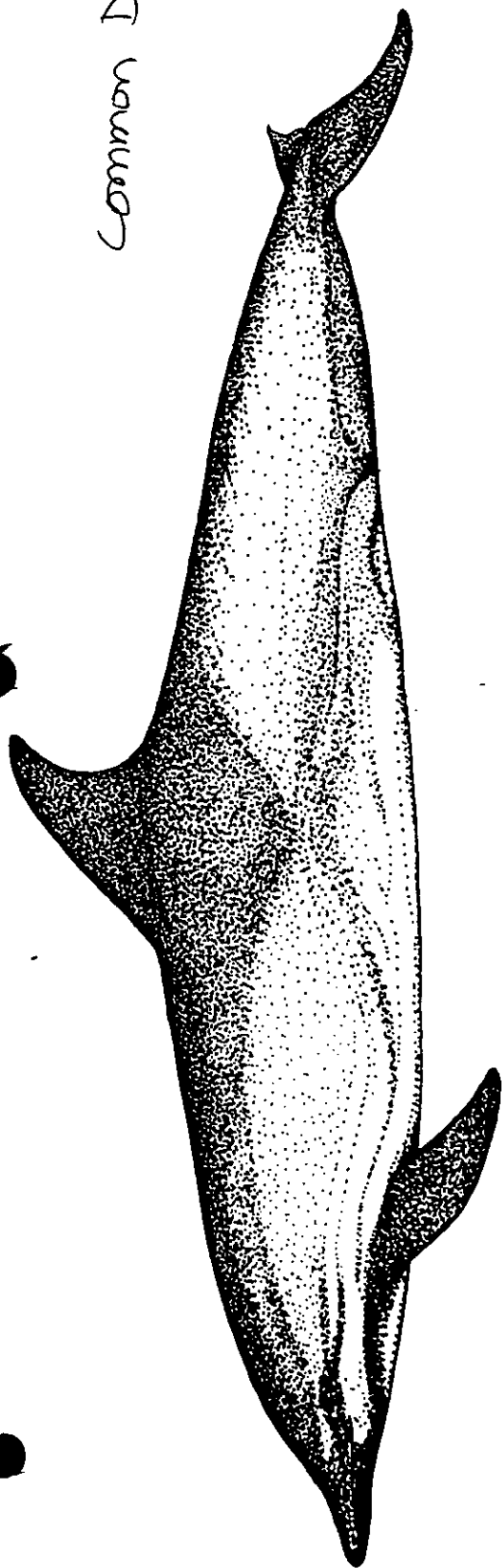


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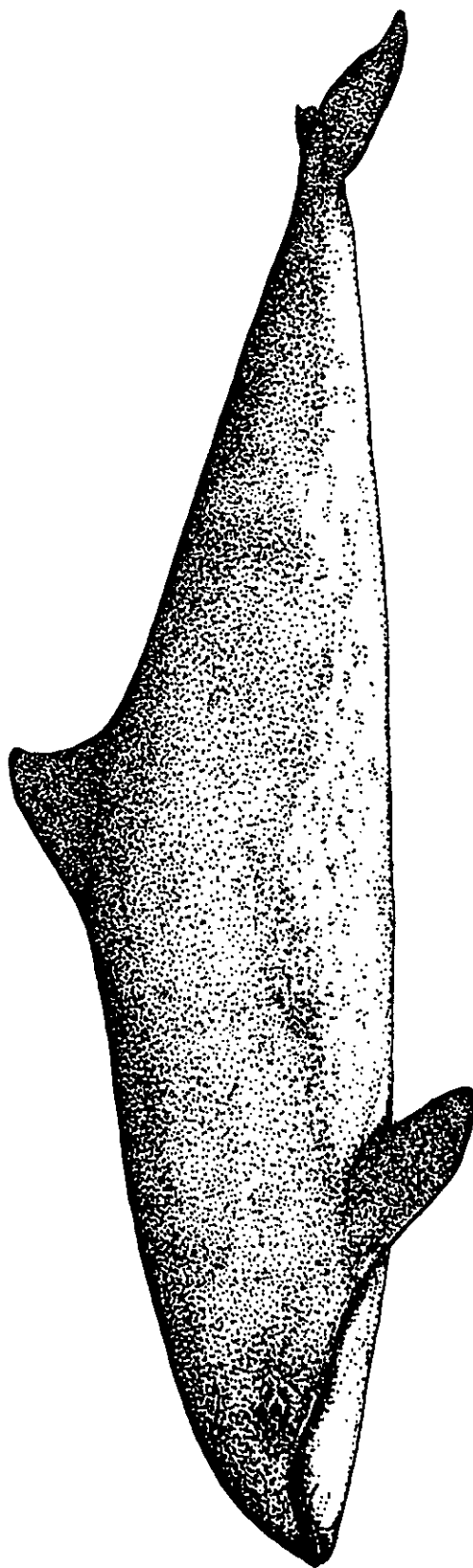


Bottlenose

Common Dolphin

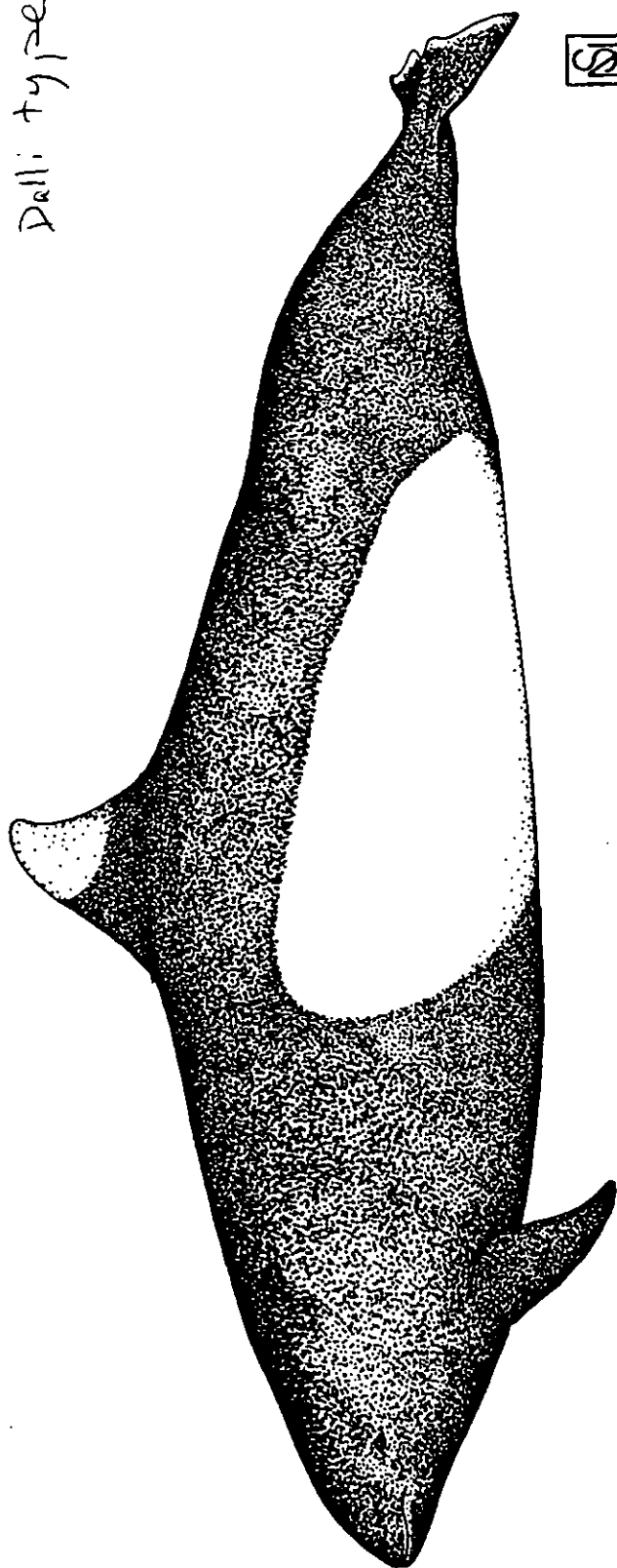


harbor porpoise
S. No. 4-4-86

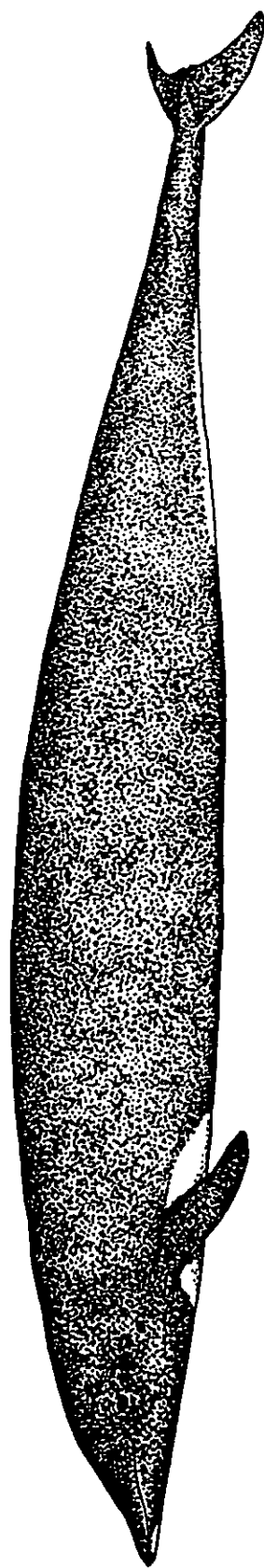


Dall's orpoise.
S. Nov 9-386

Dall's type

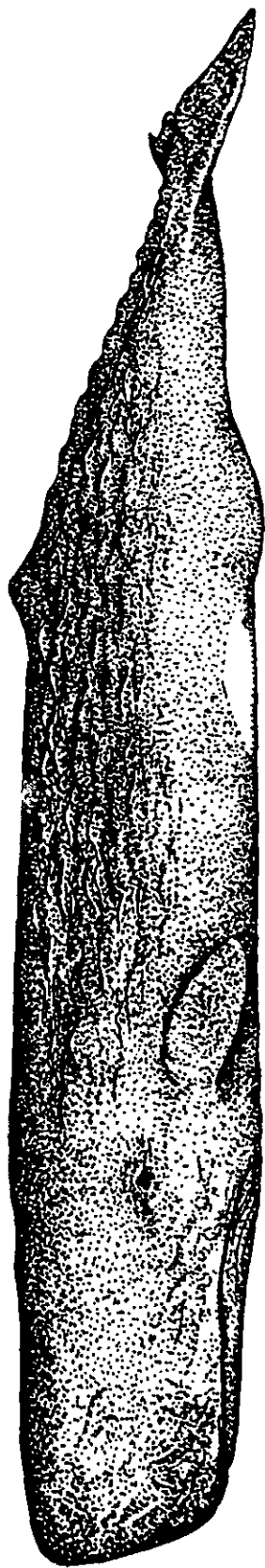


N. RIGHT WHALE DOLPHIN
S NOEL 11-8-86



Northern Right Whale
Dolphin

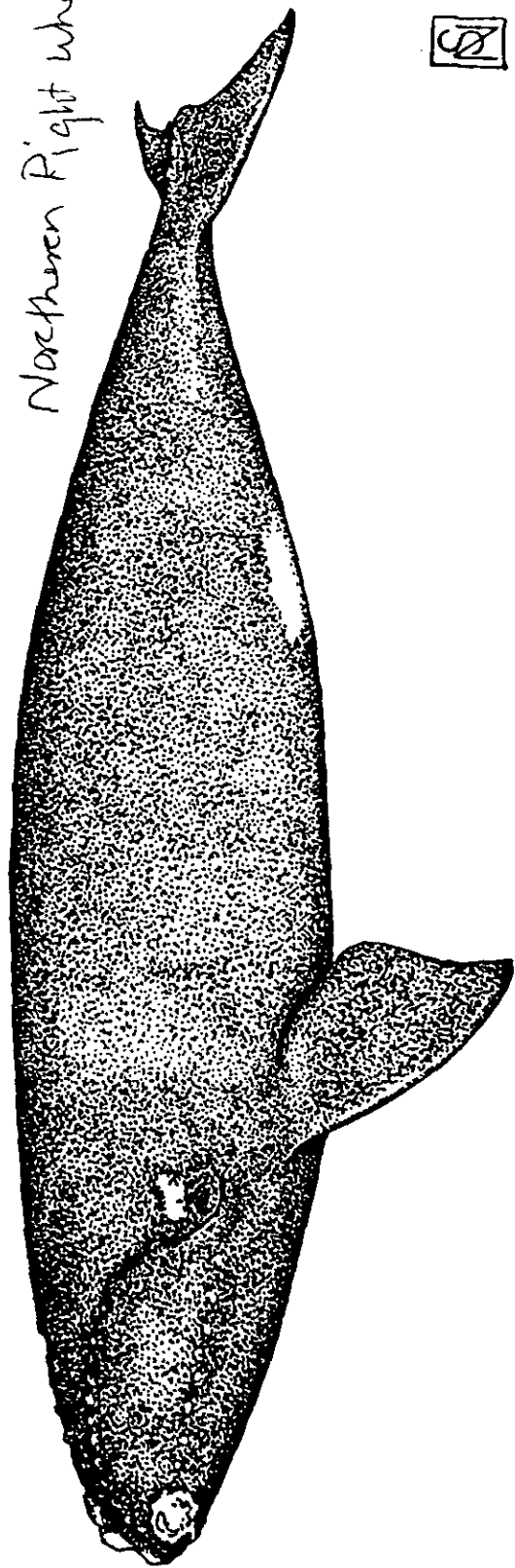
Sperm whale 3-19-80

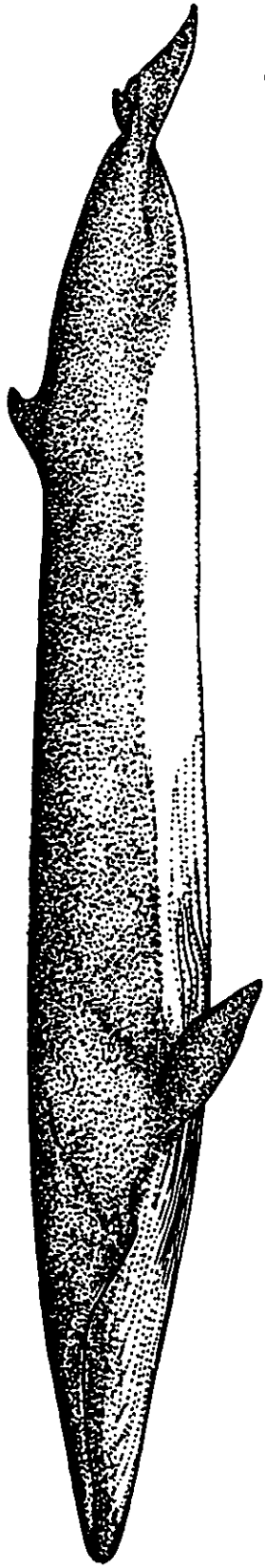


Sperm whale



Northern Right whale



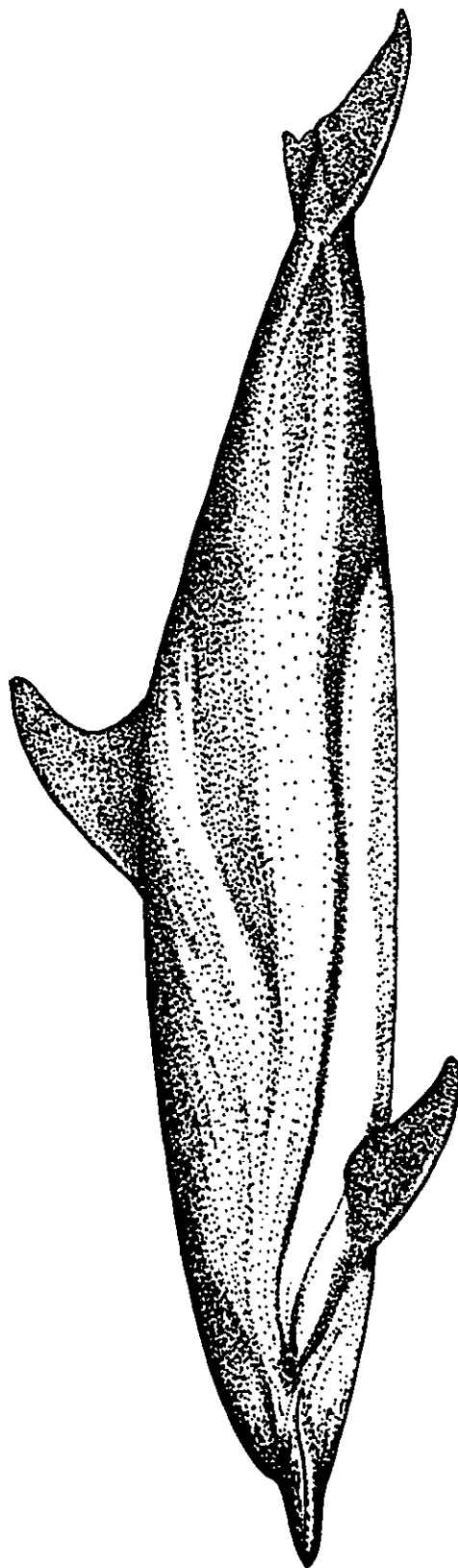


Fin whale



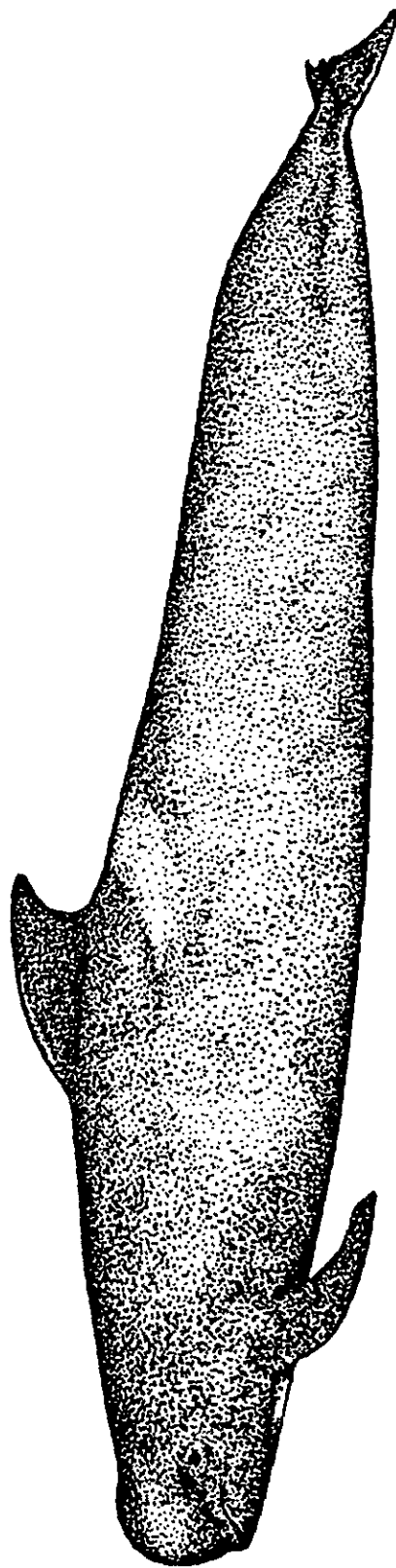
11/10/11 3-2-16
S. H. C. L.

STRIPED DOLPHIN
S. NOV 23-19-86



2

Short-finned Pilot whale
S. 1-262 3-11-86

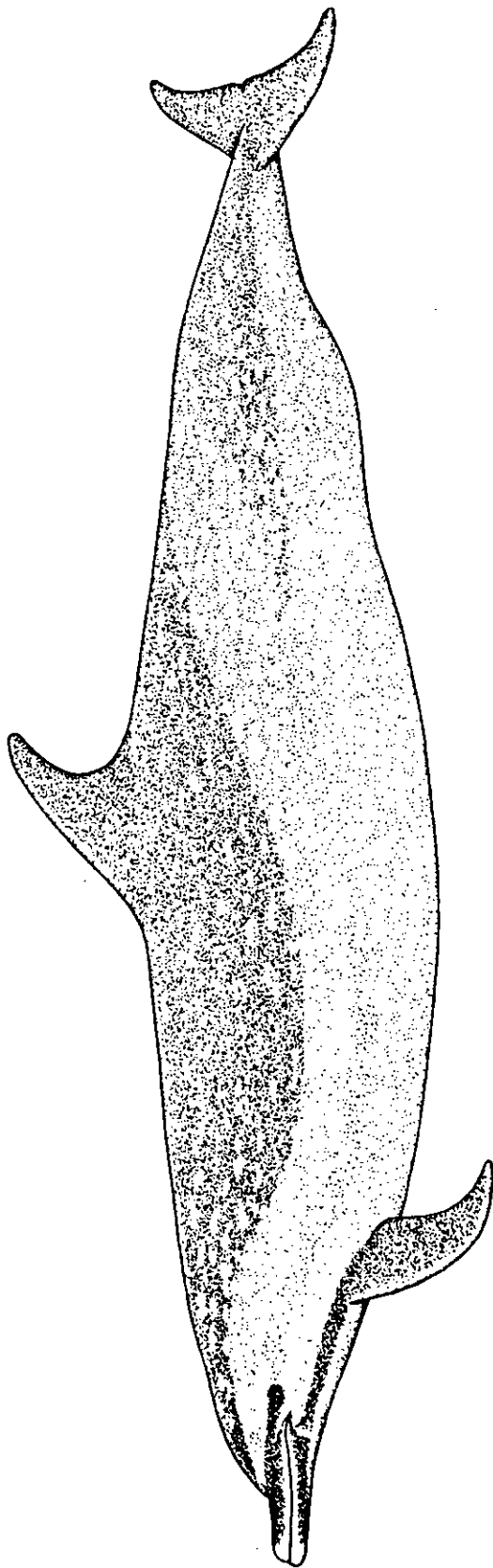


Short finned
Pilot whale

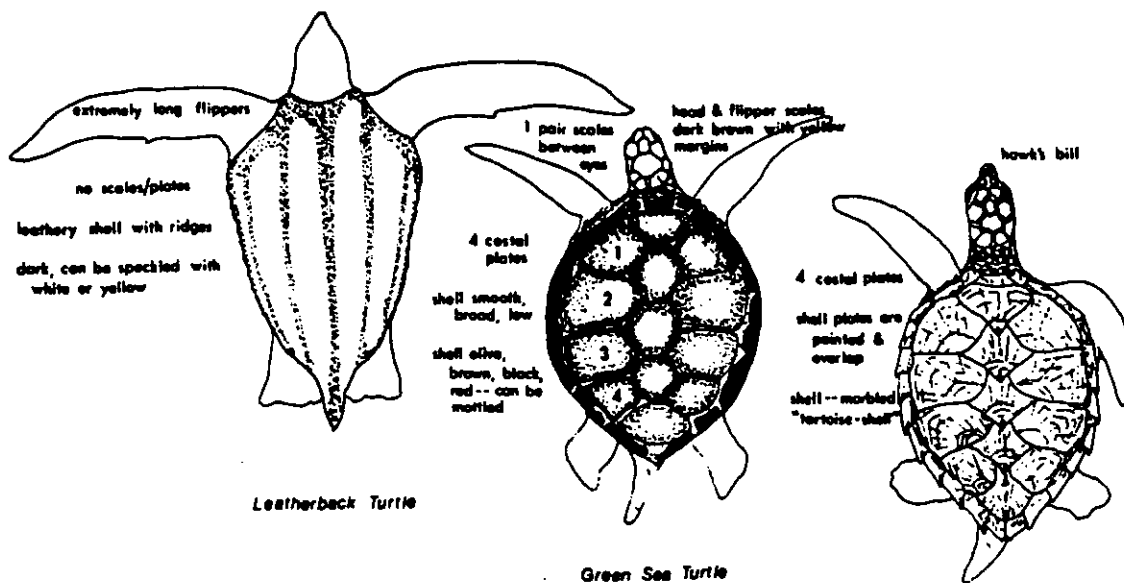


SPOTTED DOLPHIN

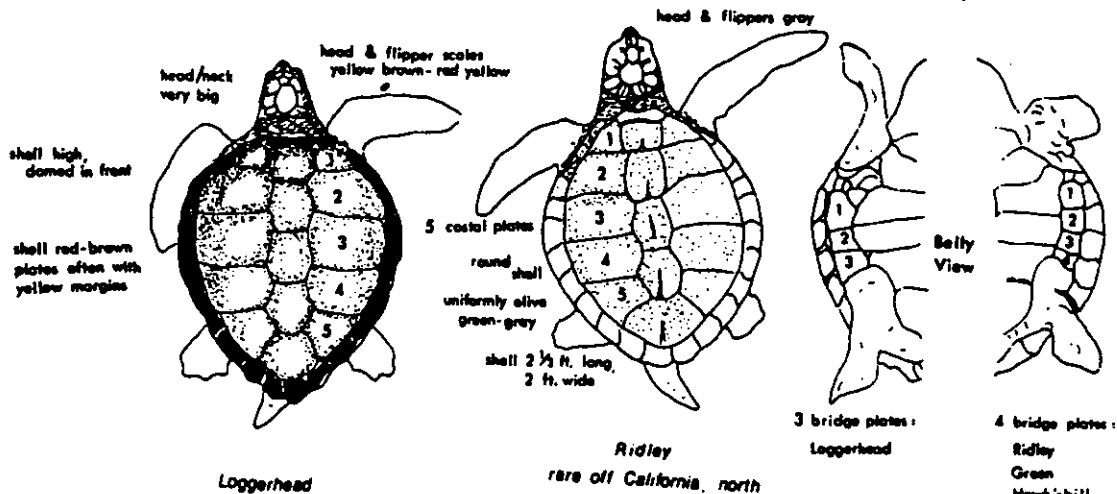
Stenella attenuata



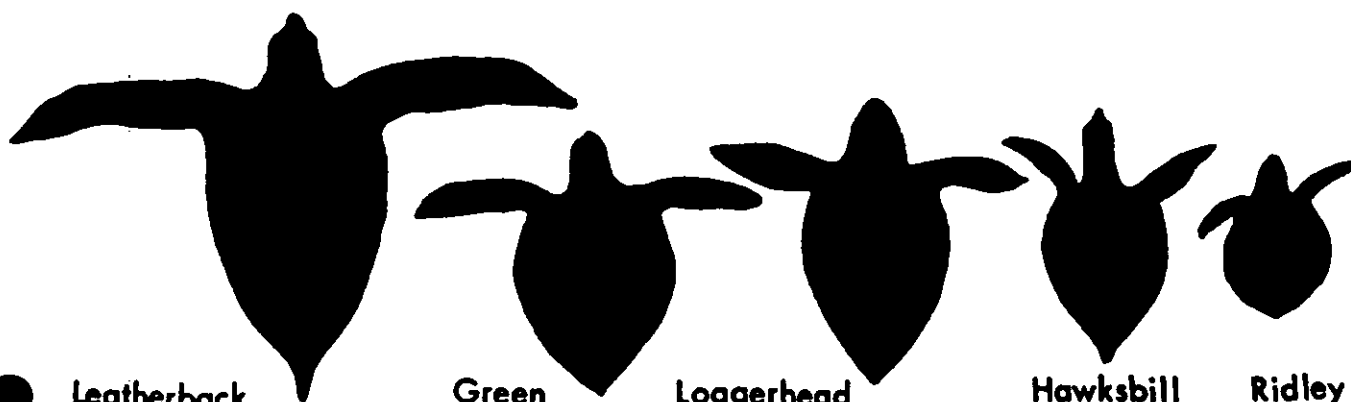
SEA TURTLES



Hawk's bill Turtle
has not been reported off California



Ridley
rare off California, north



Leatherback
8 ft 1500 lbs

Green
4 ft 400 lbs

Loggerhead
4 ft 400 lbs

Hawksbill
2-3 ft 50-100 lbs

Ridley
2 1/2 ft 80 lbs

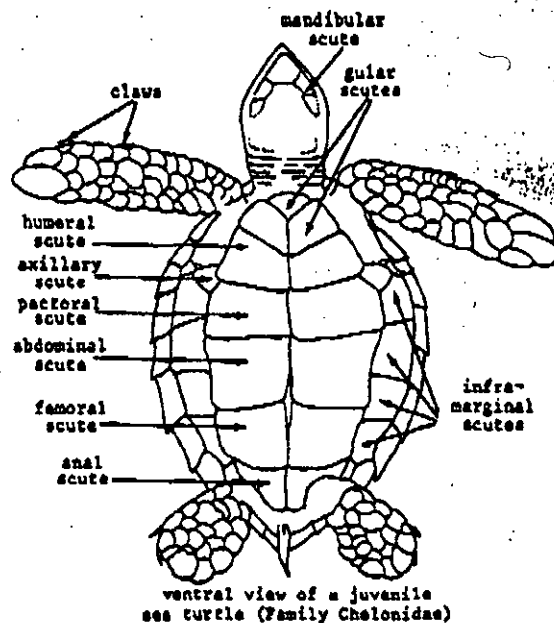
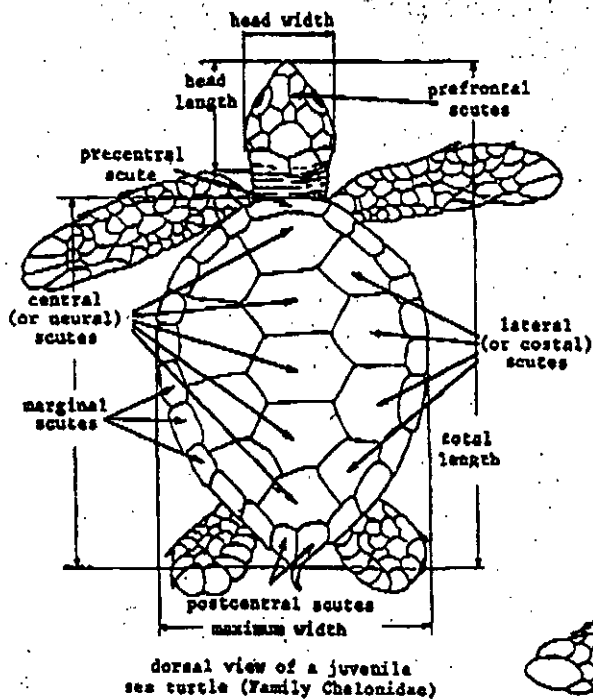
Relative Sizes and Shapes of Their Shells

FAO Sheets

SEA TURTLES

Fishing Area 31

TECHNICAL TERMS AND PRINCIPAL MEASUREMENTS USED
(Straight-line distances)



GENERAL REMARKS

The most typical feature of a turtle is the hard shell encasing the entire body. This shell is composed of a layer of bones underneath and a layer of horn on the outside; the latter often, but not always, displays a geometrical pattern of lamellae or scutes (see basic arrangement and nomenclature in the above figures). The top of the shell or carapace is joined at the sides with the bottom or plastron and the latter is notched in front and rear where the limbs emerge from the shell. All turtles have a strong, horny beak; none have true teeth, although tooth-like projections may be present on the jaws. The limbs or flippers of sea turtles are paddle-shaped.

Sea turtles occur in all tropical and warm-temperate oceans. They inhabit shallow waters along coasts and around islands, but some species are believed to be highly migratory and are found in the open sea. They are swift swimmers and some are said to attain speeds of about 35 km per hour; unlike freshwater turtles they move forward by simultaneous action of the front flippers. All species are compelled to return in regular intervals to the land during the nesting season when they lay their eggs in a nest dug into the sand. After a relatively long incubation period (usually from 45 days to two and a half months) the hatchlings go back to the sea. Very little is known about their movements and fate before they attain sexual maturity. The majority of sea turtles are predominantly carnivorous, but some species are omnivorous or even herbivorous.

Since ancient times turtles have been held in high esteem as food for man. The flesh as well as the eggs are of delicate taste and much of the production goes frozen or canned to export markets for the preparation of turtle soup, calipees, and other delicacies. Other uses are in the extraction of oil from turtle fat, in the tortoise shell industry and in the leather industry. Fishing gear at sea includes catch by hand, tangle nets, gillnets, seines and harpoons. The catch reported from Fishing Area 31 in 1974 totalled 1 551 tons.

Some marine turtle species are becoming scarce nowadays and are in bad need of protection from irrational exploitation; they are especially vulnerable on land during their nesting period. More recently, farming of sea turtles, especially of the green turtle, has been successfully introduced to some parts of the area; it is hoped that this technique will become more widespread in the near future and thus take off some of the fishing pressure exerted on the species.

The sea turtles of the Western Central Atlantic comprise only 2 families, 5 genera and 6 species.

GUIDE TO FAMILIES AND GENERA OCCURRING IN THE AREA

FAMILY CHELONIDAE

Shell, head and flippers covered with horny lamellae (scutes); horny beak never W-shaped when viewed from the front; flippers with one or two claws.

KEY TO GENERA OCCURRING IN THE AREA:

- 1 a. Horny scutes on carapace imbricated (overlapping in all except very old specimens (Figs. 1b and 1c) *Eretmochelys*
- 1 b. Horny scutes on carapace juxtaposed (not imbricated)
 - 2 a. 4 pairs of lateral (costal) scutes on carapace (Fig. 2c); edge of lower jaw coarsely toothed (Fig. 2b); a single pair of prefrontal scutes (Fig. 2a); a single pair of claws on flippers *Chelonia*
 - 2 b. 5 or more pairs of lateral (costal) scutes on carapace (Figs. 3a and 4a); 2 claws on each flipper
 - 3 a. 4 inframarginal scutes on plastron, each with a small perforation or pore toward their hind margin; carapace semicircular (Fig. 3c) *Lepidochelys*
 - 3 b. 3 pairs of enlarged inframarginal scutes without pores on plastron; carapace heart-shaped (Fig. 4c) *Caretta*

LIST OF SPECIES OCCURRING IN THE AREA:

Code numbers are given for those species for which Identification Sheets are included

<i>Caretta caretta caretta</i> (Linnaeus)	CHEL Car 1
<i>Chelonia mydas mydas</i> (Linnaeus)	CHEL Chel 1
<i>Eretmochelys imbricata imbricata</i> (Linnaeus)	CHEL Eret 1
<i>Lepidochelys kempi</i> (Garman)	CHEL Lepid 1
<i>Lepidochelys olivacea</i> (Eschscholtz)	CHEL Lepid 2

FAMILY DERMOCHELIDAE

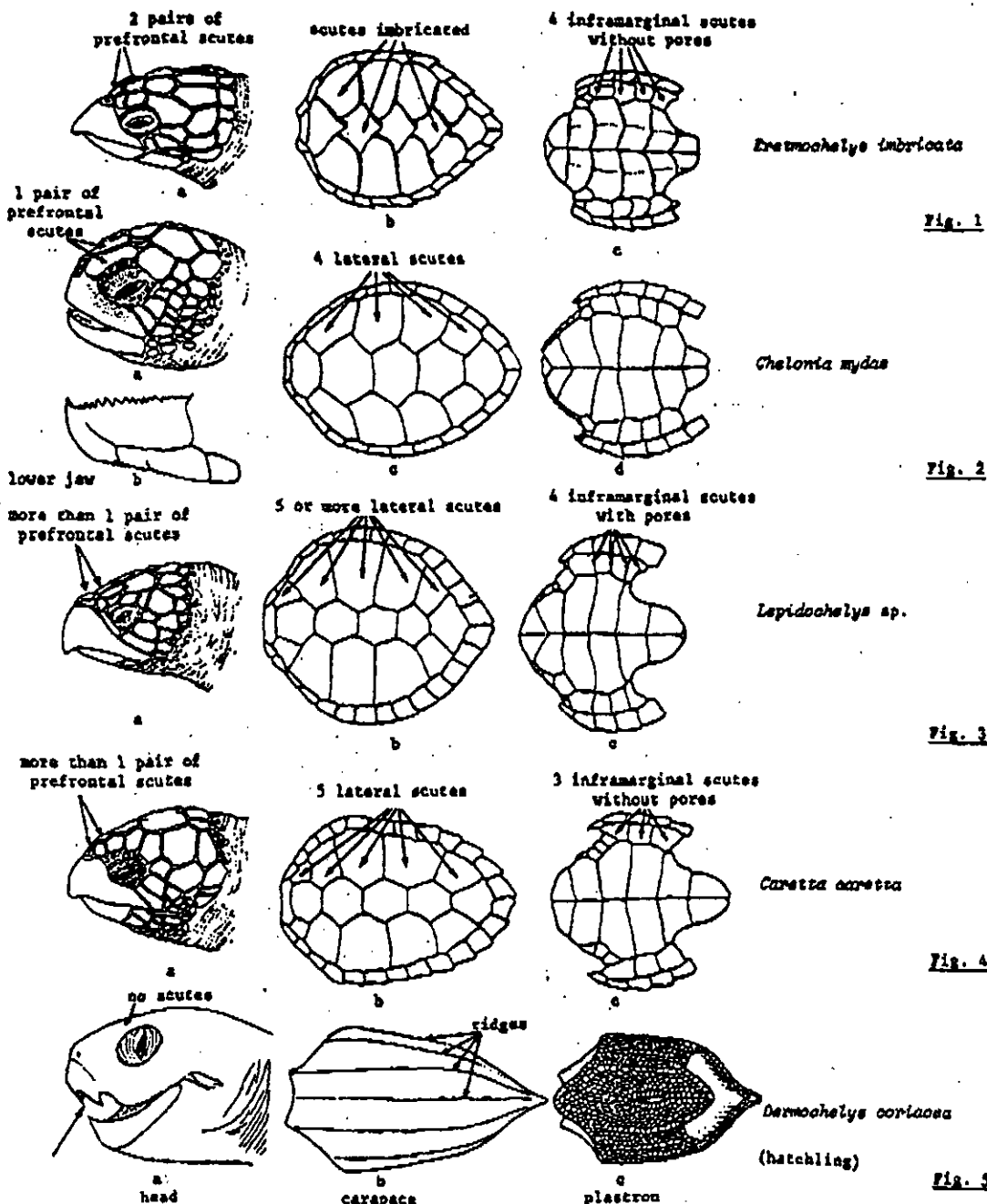
Horny skin smooth, scuteless; carapace black with 7 narrow longitudinal ridges (Fig. 5b), plastron with 5 longitudinal ridges (Fig. 5c); upper jaw with a well-defined cusp on each side, giving the horny beak a U-shaped appearance when viewed from the front (Fig. 5a); flippers without claws, the anterior pair much larger, the posterior broadly connected with the tail by a web in adults.

A single species occurring in the area:

<i>Dermochelys coriacea coriacea</i> (Linnaeus) (Fig. 5)	DERMO Dermo 1
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Prepared by M. Márquez, R., Mexico City, Mexico

PICTURE GUIDE TO SPECIES OCCURRING IN THE AREA

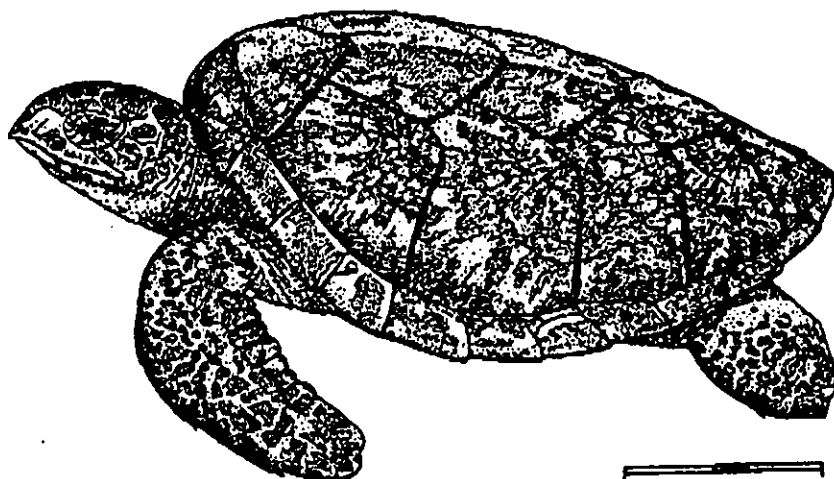


FAO SPECIES IDENTIFICATION SHEETS

FAMILY: CHELONIDAE

FISHING AREA 31
(W Cent. Atlantic)*Eretmochelys imbricata* (Linnaeus, 1766)

OTHER SCIENTIFIC NAMES STILL IN USE: None



VERNACULAR NAMES:

FAD: En - Atlantic hawksbill turtle
 Fr - Tortue caret de l'Atlantique
 Sp - Tortuga de carey del Atlántico

NATIONAL:

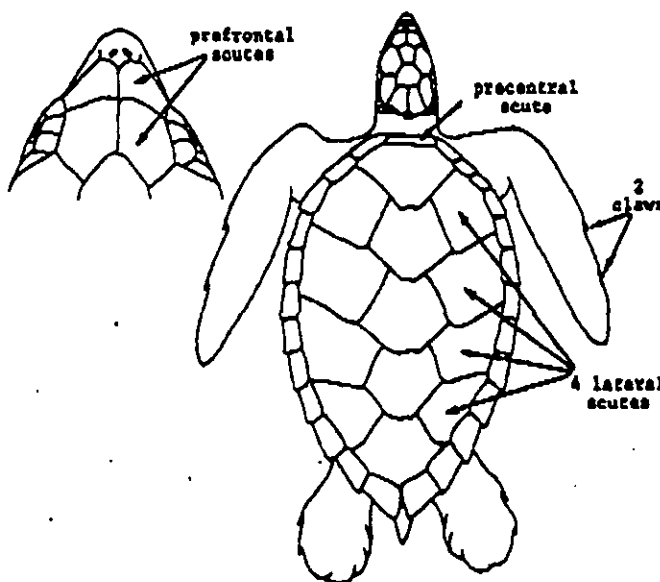
DISTINCTIVE CHARACTERS:

Carapace oval, depressed, its width about 75% of the length. Head medium-sized (about 27% of carapace length), with 3 pairs of prefrontal scutes and a strong horny beak. Scutes on shell imbricated (overlapping) in all but very old specimens where they are juxtaposed; 4 pairs of lateral scutes on carapace, anterior pair not touching the pre-central scute; 4 pairs of inframarginal scutes on plastron; 2 claws on each flipper.

Colour: upper side dark brown, with yellow and reddish streaks on scutes; underside pale yellow.

Eggs: white, spherical, 3.5 to 4.0 cm in diameter and 28 g in weight.

Hatchlings: length of carapace about 4.5 cm; colour dark brown.



DISTINGUISHING CHARACTERS OF SIMILAR SPECIES OCCURRING IN THE AREA:

No other adult sea turtle from this area has imbricated scutes on carapace or plastron; the only other species with 4 lateral scutes on the carapace is *Chelonia mydas*, but the carapace is much broader, the flippers bear a single claw and the lower jaw is roughly toothed (smooth in *E. imbricata*).

SIZE:

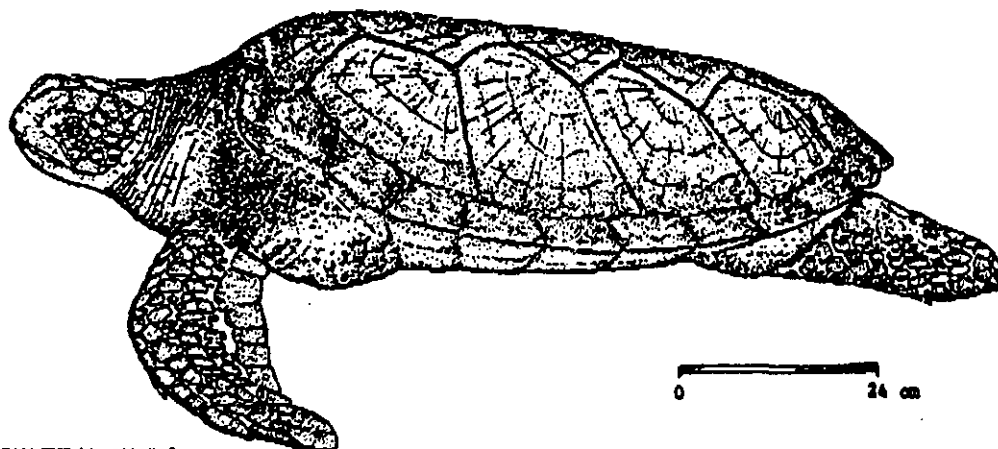
Carapace length (straight-line distance): maximum to 90 cm; common to 80 cm.
 Weight: maximum to 120 kg; common to 60 kg.

FAO SPECIES IDENTIFICATION SHEETS

FAMILY: CHELONIDAE

FISHING AREA 31
(W Cent. Atlantic)*Chelonia mydas mydas* (Linnaeus, 1758)

OTHER SCIENTIFIC NAMES STILL IN USE: None



VERNACULAR NAMES:

FAO: En - Atlantic green sea turtle
Fr - Tortue verte de l'Atlantique
Sp - Tortuga verde del Atlántico

NATIONAL:

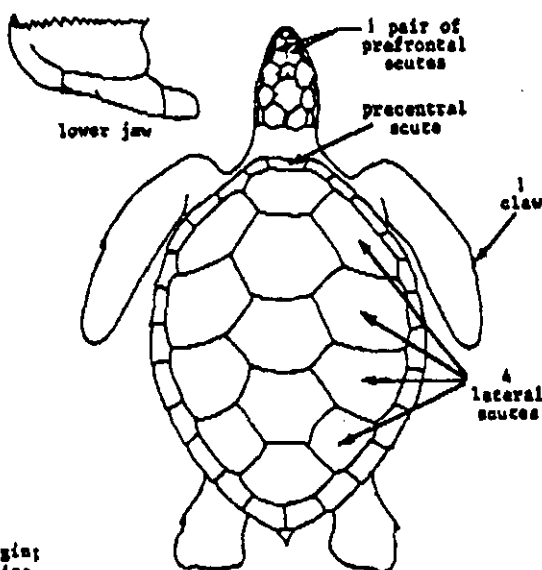
DISTINCTIVE CHARACTERS:

Carapace oval, depressed, its width about 88% of the length. Head small (about 20% of carapace length), with a single pair of prefrontal scutes; edge of lower jaw coarsely toothed, that of upper jaw with strong ridges on inner surface. Four pairs of lateral scutes on carapace, anterior pair not touching the precentral scute; 4 pairs of inframarginal scutes on plastron; a single claw on each flipper.

Colour: upper side olive brown, scutes of carapace shiny with radiating yellow, green and black spots; underside pale yellow, creamy or whitish.

Eggs: white, spherical, about 4.5 cm in diameter.

Hatchlings: length of carapace about 5 cm. Upper side brownish black, posterior portion of carapace and flippers with a white margin; underside of neck, body and flippers yellowish white.



DISTINGUISHING CHARACTERS OF SIMILAR SPECIES OCCURRING IN THE AREA:

Other sea turtles with horny scutes on shell: edges of jaws smooth and more than one pair of prefrontal scutes; also, scutes on shell imbricated in *Eretmochelys imbricata* and 3 or more lateral scutes in the remaining species (4 lateral scutes in *C. mydas*).

SIZE:

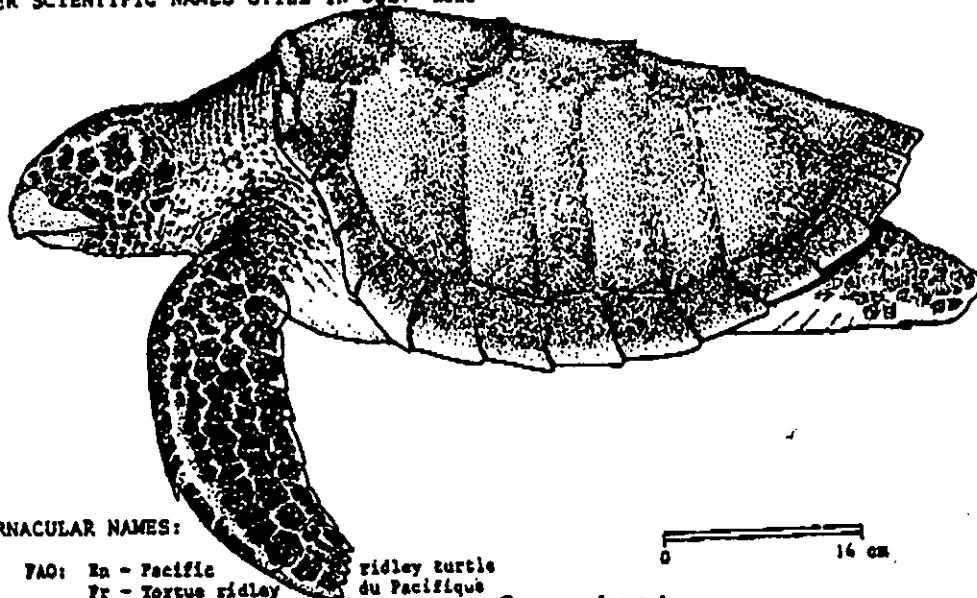
Carapace length (straight line distance): maximum to 105 cm; common to 90 cm.
Weight: maximum to 140 kg; common to 100 kg.

FAO SPECIES IDENTIFICATION SHEETS

FAMILY: CHELONIDAE

FISHING AREA 31
(W Cent. Atlantic)*Lepidochelys olivacea* (Eschscholtz, 1829)

OTHER SCIENTIFIC NAMES STILL IN USE: None



VERNACULAR NAMES:

FAO: En - Pacific ridley turtle
Fr - Tortue ridley du Pacifique
Sp - Tortuga golfina

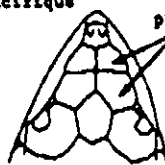
NATIONAL:

DISTINCTIVE CHARACTERS:

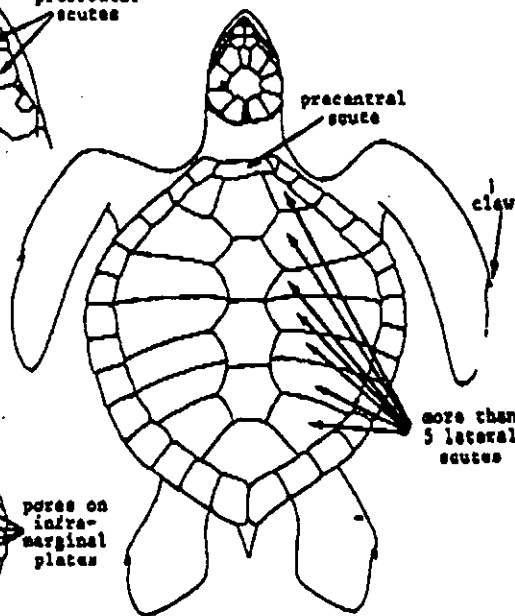
Carapace circular in outline, depressed, its width about 90% of the length. Head small (about 22% of carapace length) with 2 pairs of prefrontal scutes and a horny beak which may be finely serrated. Usually more than 8 pairs (sometimes even 7) of lateral scutes on carapace, anterior pair touching the precentral scute; 4 pairs of inframarginal scutes, each perforated by a pore toward its hind margin; adults with only 1 claw on each flipper.

Colour: upper side olive brown; underside yellowish white.

Eggs: white, spherical, about 3.9 cm in diameter and 33 g in weight.



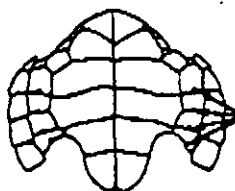
prefrontal scutes



precentral scute

claw

more than 5 lateral scutes



plastron

pores on infra-marginal plates

Hatchlings: length of carapace about 4 cm; shell with 3 longitudinal ridges above and 2 below; scutes slightly imbricated. Colour grayish to black with yellow margins to the shell.

DISTINGUISHING CHARACTERS OF SIMILAR SPECIES OCCURRING IN THE AREA:

Lepidochelys kampfi: similar in shape, but very rarely found in the area occupied by *L. olivacea*; colour lighter, predominantly grayish; carapace slightly broader and more strongly depressed, its margin curved upward and the central scutes convex (nearly flat in *L. olivacea*); 5 pairs of lateral scutes on carapace (usually more than 5 in *L. olivacea*).

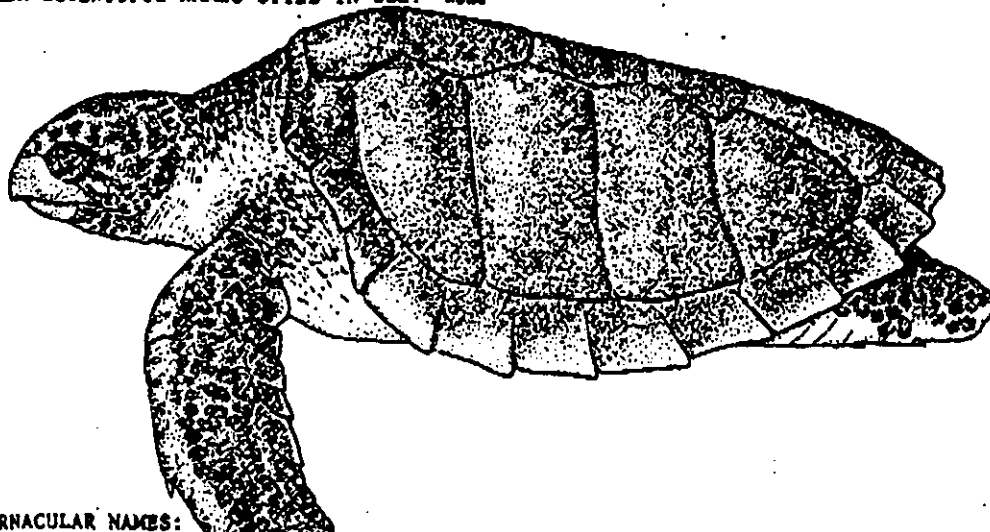
No other turtle species occurring in the area has pores on the inframarginal scutes or a nearly circular carapace.

FAO SPECIES IDENTIFICATION SHEETS

FAMILY: CHÉLONIDAE

FISHING AREA 31
(W Cent. Atlantic)*Caretta caretta caretta* (Linnaeus, 1758)

OTHER SCIENTIFIC NAMES STILL IN USE: None



VERNACULAR NAMES:

PAO: En - Atlantic Loggerhead turtle
 Fr - Tortue caouane de l'Atlantique
 Sp - Tortuga cabuana del Atlántico

NATIONAL:

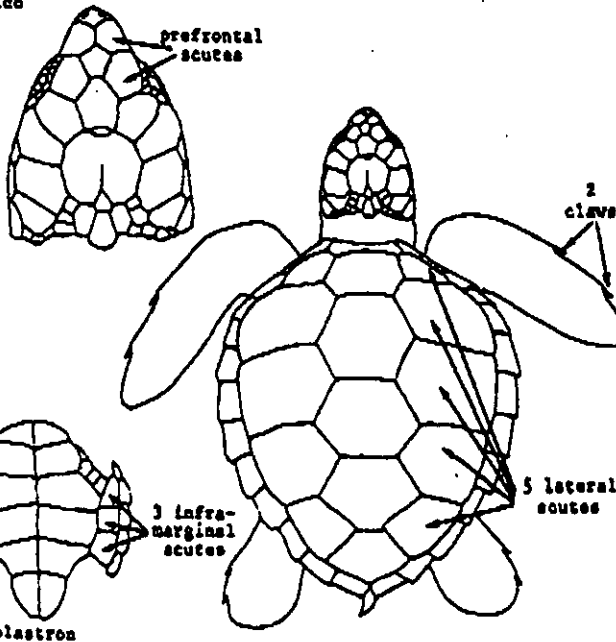
DISTINCTIVE CHARACTERS:

Carapace heart-shaped, depressed, its width about 76% of the length. Head rather long (about 28% of carapace length) and very broad, with 8 pairs of prefrontal scutes and a strong horny beak. Five pairs of lateral scutes, anterior pair touching the precentral scute; 3 pairs of enlarged inframarginal scutes on plastron; 2 claws on each flipper.

Colour: upper side brownish red with light spots; underside pale yellow with diffuse orange spots.

Eggs: white, spherical, about 4.3 cm in diameter and 36 g in weight.

Hatchlings: length of carapace about 4.5 cm. Colour dark brown with light margins, except for the keels of the plastron which are lighter.



DISTINGUISHING CHARACTERS OF SIMILAR SPECIES OCCURRING IN THE AREA:

Other sea turtles with horny scutes on shell: head narrower, carapace broader (except *Eretmochelys imbricata* which is easily distinguished by its imbricated scales); 4 inframarginal plates on plastron (3 in *Caretta caretta*); upper side of carapace usually not brownish red.

SIZE:

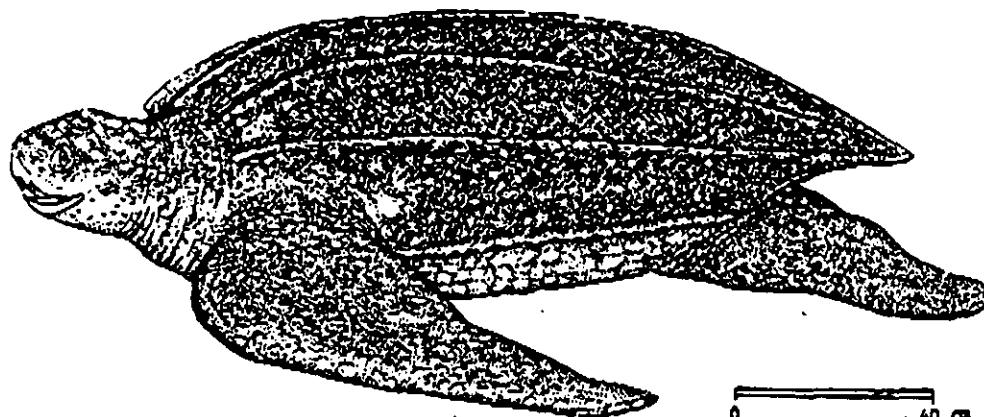
Carapace length (straight-line distance): maximum to 125 cm; common to 110 cm.
 Weight: maximum to 140 kg; common to 105 kg.

FAO SPECIES IDENTIFICATION SHEETS

FAMILY: DERMOCHELIDAE

FISHING AREA 31
(W Cent. Atlantic)*Dermochelys coriacea coriacea* (Linnaeus, 1758)

OTHER SCIENTIFIC NAMES STILL IN USE: None



VERNACULAR NAMES:

FAO: En - Atlantic leatherback turtle
 Fr - Tortue luth de l'Atlantique
 Sp - Tortuga laud del Atlántico

NATIONAL:

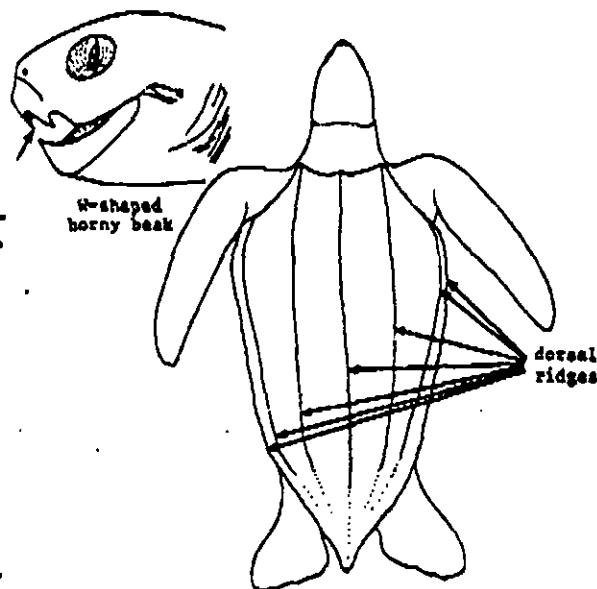
DISTINCTIVE CHARACTERS:

Body depressed and covered by a smooth horny skin lacking lamellae or scutes. Head small, ending in a horny beak with a well defined cusp at each side of upper jaw and a central cusp on lower jaw (beak W-shaped when viewed from the front). 7 longitudinal ridges (including the outer or lateral pair) on carapace and 6 on plastron. Flippers very large, without claws.

Colour: upper side dark brown to almost black; whitish spots on neck, increasing in number on the ventral and caudal areas.

Eggs: white, spherical, normally about 5.5 cm in diameter; unfertilised small eggs may often be found.

hatchlings: length of carapace about 5.5 cm. They show basically the same features as the adult, but the flippers are much larger and the skin is rugose with a reticulate pattern of small scales. Upper side black, with lateral ridges white; under-side white, mottled with light brown.



DISTINGUISHING CHARACTERS OF SIMILAR SPECIES OCCURRING IN THE AREA:

All other sea turtles occurring in the area have horny lamellae or scutes all over their body and adults lack the longitudinal ridges on carapace and plastron.

SIZE:

Carapace length (straight line distance): maximum to 180 cm; common to 140 cm.
 Weight: maximum to 725 kg; common to 300 kg.

NEON FLYING SQUID - Main target species of fishery

***Ommastrephes bartrami* (LeSueur, 1821)**

OMMAS Ommas 2

Loligo bartrami LeSueur, 1821, *J.Acad.Nat.Sci.Phila.*, 2(1):90.

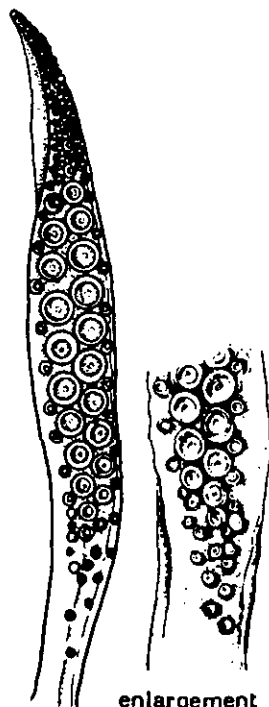
Synonymy : *Loligo bartrami* LeSueur, 1821; *Sthenoteuthis bartrami* - invalid generic name.

FAO Names : En - Neon flying squid
Fr - Encornet volant
Sp - Pota saltadora

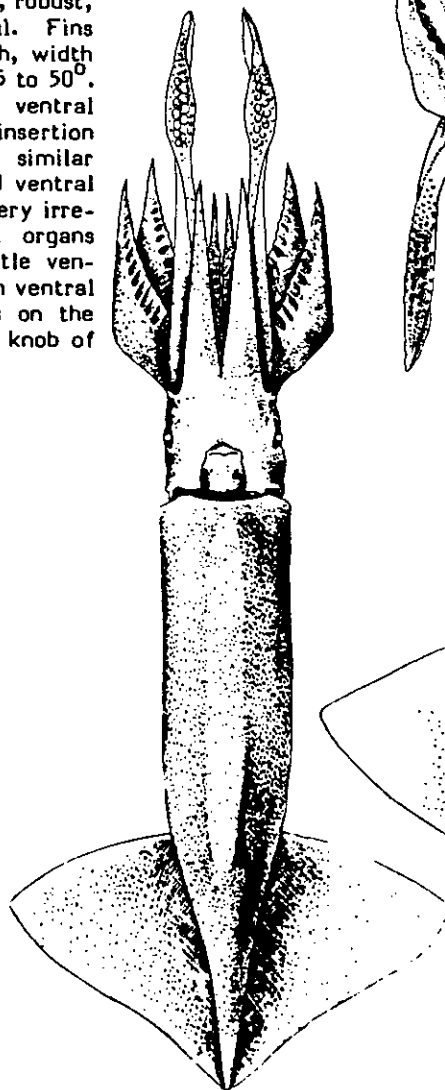
Diagnostic Features : Mantle muscular, robust, not drawn out posteriorly into a pointed tail. Fins muscular, length 40 to 45% of mantle length, width about 60% of mantle length, single fin angle 45 to 50°. A long golden or silvery stripe along the ventral midline from mantle opening to level of fin-insertion (this stripe probably is a luminescent organ); similar golden tissue on ventral surfaces of head and ventral arms (IV); numerous closely-packed, small, very irregularly shaped, often interconnected, light organs embedded under the skin in muscle of mantle ventrally; similar light organs occur in patches on ventral surface to head. Four to six small suckers on the tentacular stalk proximal to the first smooth knob of the fixing apparatus.



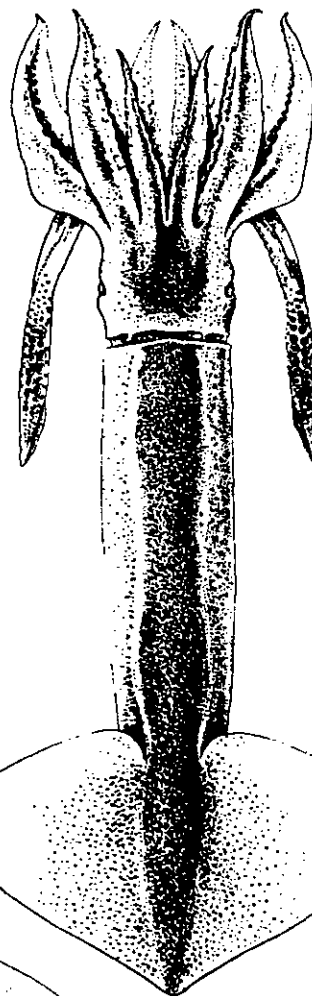
arms IV of male
hectocotyliized



enlargement
of base
tentacular club

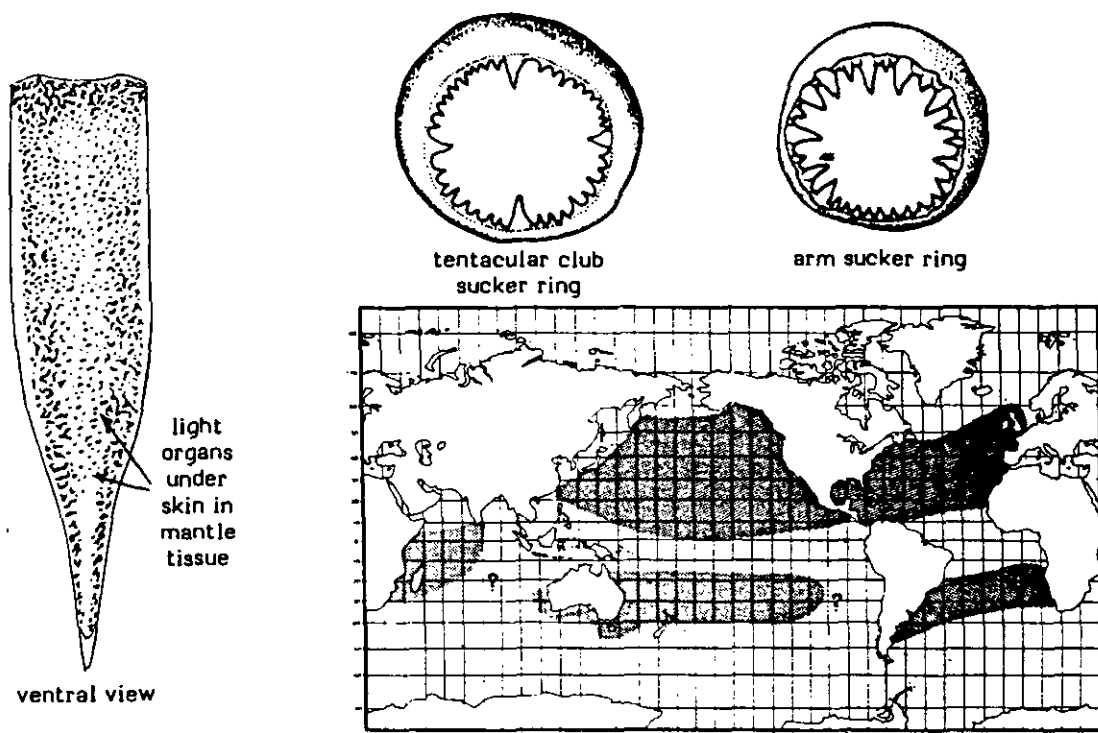


ventral view



dorsal view

NEON FLYING SQUID, Ommastrephes bartrami



Geographical Distribution : Worldwide in subtropical and temperate oceanic waters, but distribution discontinuous (apparently non-tropical, absent in equatorial waters).

Habitat and Biology : An oceanic species occurring from the surface to approximately 1 500 m depth. In the northwestern Pacific, population densities are highest in the boundary zone between warm and cold waters, particularly from July to August (water temperature gradient 15 to 24°C) and from end of September to December (10 to 22°C). This species avoids waters of less than 10°C. It carries out seasonal migrations. Throughout summer and fall, dense schools are encountered associated with the movements of the Kuroshio current, feeding in surface waters, which migrate to deeper waters and disperse during winter and spring. During the feeding season, diurnal vertical migrations have been observed between nearsurface waters at night and deeper layers in daytime. From July through October most individuals are immature; both sexes mature between January and April, the males about 3 months earlier than the females. The spawning season is rather extended (January to May off Japan) and hence it is possible to distinguish a "fast"-growing and a "slow"-growing group, depending on the environmental conditions at hatching and in the initial juveniles stages. Growth rates are directly correlated with temperature and inversely with size. The lifespan is about 1 year. Food of flying squid consists predominantly of fishes, such as lanternfishes, sardines, mackerel larvae, and sauries. Other squids account for up to 30% of the stomach contents, including a high percentage of cannibalism, while pelagic crustaceans form a highly variable, but usually minor fraction (particularly in adult squids).

Size : Maximum mantle length 50 cm in females; males somewhat smaller; maximum weight 1.8 kg. Off Japan, females mature at little less than 40 cm, males between 29 and 32 cm.

200 cm in Korean fishery obs. 1988

Interest to Fisheries : With the decline of the stocks of *Todarodes pacificus*, the effort of the Japanese squid fishery has been increasingly shifting towards the exploitation of flying squid, and since 1974 catch and effort levels for this species have gone beyond the exploratory fishing stage. Landings increased from 17 000 tons in 1974 to about 150 000 tons in 1978 and 187 000 tons in 1980, primarily as a result of the eastward expansion of the fishing grounds. An annual 'fishery forecast' is prepared in Japan for the fishing grounds in the Japan Sea and the Pacific. During its northward migration in early summer, the species is fished off northeastern Honshu, between the surface and about 150 m depth with jigging machines, while in the Tasman Sea, off New Zealand and in the North Pacific, it is caught with drift gillnets. Although it is abundant in other oceans, there are currently no fisheries directed at this species outside the Pacific. The current level of exploitation is suspected to exceed the optimum sustainable yield. The flesh is of good quality for human consumption, although somewhat tough in mature individuals. It is marketed fresh and frozen.

Local Names : AUSTRALIA: Red ocean squid; JAPAN: Akaika, Bakaika, Medama, Murasakiika; USA: Neon flying squid.

Literature : Ishi (1977, growth, northwestern Pacific); Murata & Ishi (1977, biology, northwestern Pacific); Roper & Sweeney (1981, Species Identification Sheets, eastern central Atlantic, fishing areas 34/47 in part).

It seems apparent that members of the family occur in the North Pacific (none had been recorded previous to 1966 - Clarke, 1966), but their specific identity (or identities) will have to await the collection of more and larger individuals.

Family OMMASTREPHIDAE Steenstrup, 1857

Characterized by a funnel-locking cartilage in the shape of an inverted T (fused at one point in Symplectoteuthis). Buccal connectives attach dorsally to arms IV; brachial armature is biserial; club armature is tetraserial or octoserial. Photophores may be present.

Subfamily OMMASTREPHINAE Steenstrup, 1857

Funnel groove with foveola and several side pockets; photophores present.

Ommastrephes bartramii (LeSueur, 1821)

Four equidistant enlarged teeth in each of the largest tentacular sucker rings. Four to six suckers proximal to the first knob of the fixing apparatus. A broad midventral silvery strip on the mantle. Arm tips not attenuate.

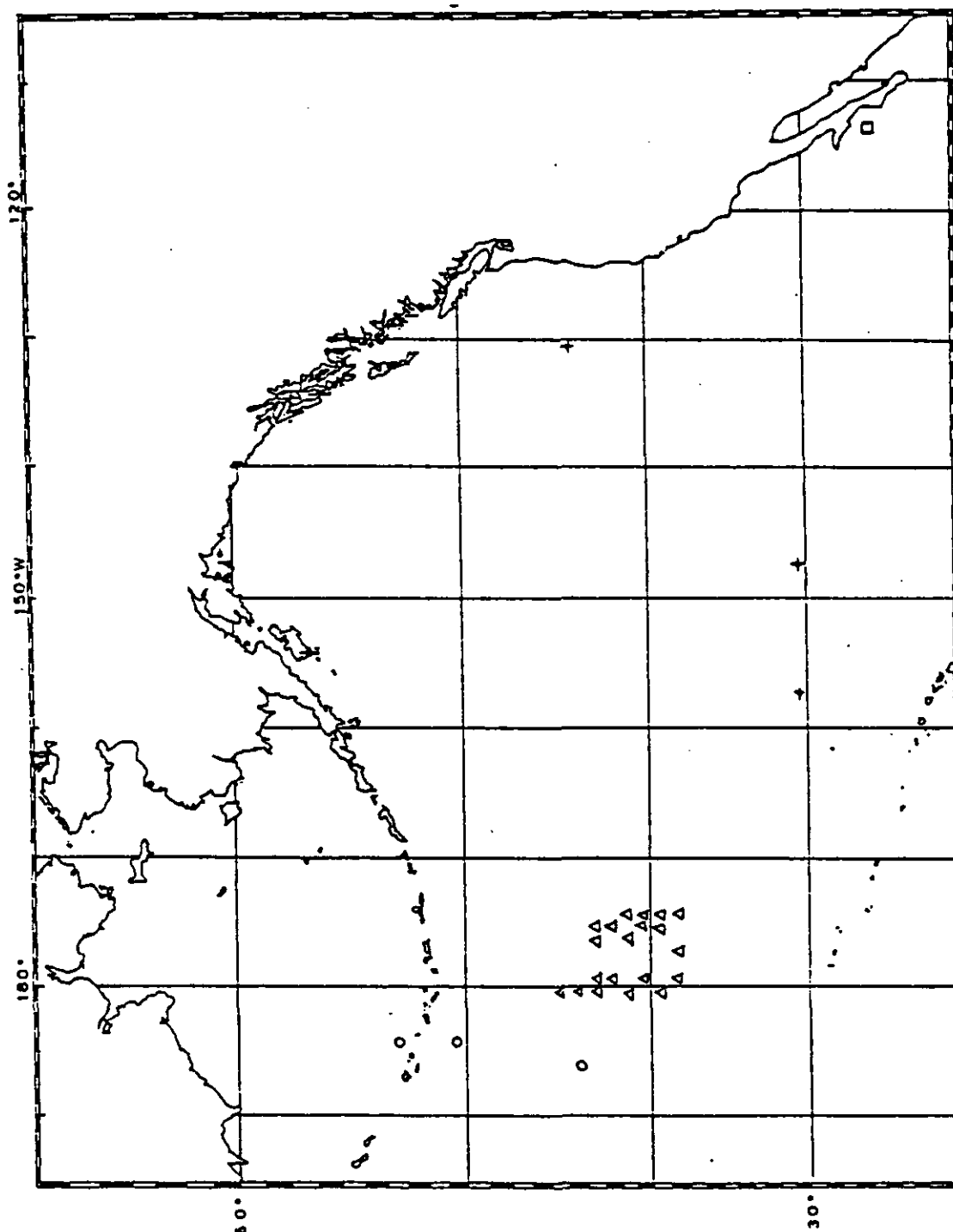
Four individuals (99-230 mm DML; OSUI 402, 763-765) were taken: three by dipnet in central Pacific waters, and one by bow and arrow in the California Current (Figure 42). An additional specimen (146 mm DML) was dipnetted at 11°S, 110°W. This species, which has in the past not always been effectively separated from its congeners, O. caroli and O. pteropus, is reported to be a

tropical-subtropical cosmopolite. It may, however, especially in the Pacific, more closely approximate an antitropical distribution (Nesis, 1973b; Wormuth, 1976; Okutani, 1977), common between 20° and 40°S, and from 25° to 45°N. It was taken in salmon gillnets by T/V Oshoro Maru between 38° and 45°N, and 174° and 179°E (Faculty of Fisheries, Hakodate, 1979, 1980) and further north (Fiscus and Mercer, 1982) (see Figure 9). Nesis (1973b) considered it to be generally limited to waters of 16°C or higher. Although taken in waters as cool as 10.7°C (one individual) by T/V Oshoro Maru in 1978, and as cool as 12.4°C in 1979, the number of individuals captured was roughly proportional to temperature. Fiscus and Mercer (1982) reported collections at 9.8° to 9.9°C (50-53°N, 175°E) and at 12°C (44°N, 173°E).

Naito et al. (1977a) listed its temperature range as 8-24°C, with abundant captures at 12-18°C. It appears to grow to maturity in one year, reaching a maximum size of 480 mm DML for the females, and 410 mm for the males. The adults eat small fish (Diaphus coeruleus, Engraulis japonica, Sardinops melanosticta, and young Scomber japonicus) and other Q. bartramii and Watasenia scintillans, but no Crustacea. Immature individuals eat euphausiids and Pararthemisto as well as small fish and squid (Naito et al., 1977b).

This species is an extremely powerful swimmer; adults are seldom captured in standard oceanographic nets. Identification of the larvae remains a problem.

Figure 42. Location of hauls which captured Ommastrephes bartramii (crosses; triangles represent captures by T/V Oshoro Maru; circles represent gill net captures - Fiscus and Mercer, 1982; one additional specimen was taken at 11°S, 110°W) and Dosidicus gigas (square; two additional individuals were taken at 9°S, 80°W).



Gonatopsis borealis Sasaki, 1923

EIGHT-ARMED SQUID

GONA Gona 1

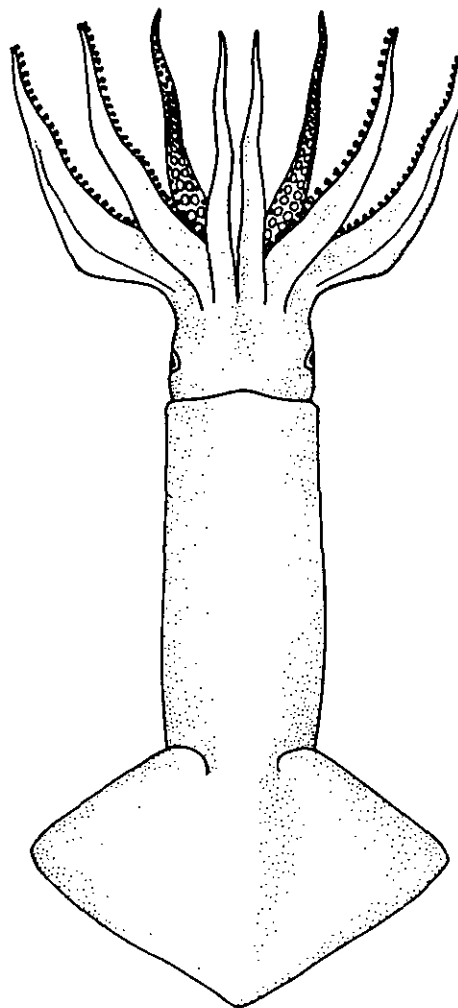
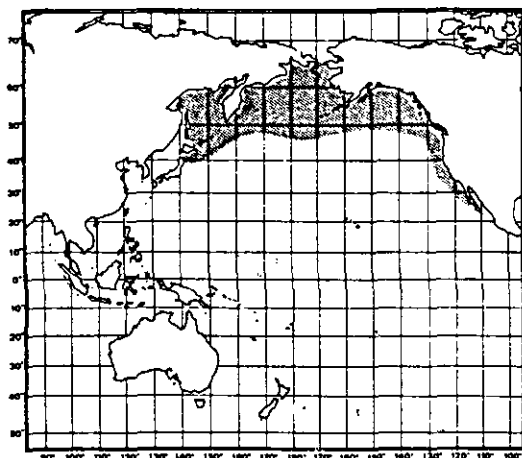
Gonatopsis borealis Sasaki, 1923, Annot.Zool.Japan, 10:202.

Synonymy : None.

FAO Names : En - Boreopacific gonate squid
Fr - Encornet boréopacifique
Sp - Gonalura pacificoboreal

Diagnostic Features : Mantle stout, thick, muscular. Fins muscular, relatively short (40 to 45% of mantle length) and broad (65 to 70% of mantle length). Tentacles absent (present only in larvae). Arms robust, muscular, 40 to 50% of mantle length; arms I to III with medium rows of hooks and 2 marginal rows of suckers; arm IV with 4 rows of suckers, no hooks.

Geographical Distribution : Northern Pacific: Northern Japan through the Bering Sea, from the Aleutian Islands to California.



dorsal view

Habitat and Biology : An oceanic species in cold temperate waters, encountered in midwaters to about 700 m depth. It is known to undertake diel vertical migrations and to form increasingly large aggregations between April and early autumn, particularly in the eastern and western parts of the north Pacific. It is heavily preyed upon by sperm whales.

Size : Maximum mantle length 30 cm.

Interest to Fisheries : Incidentally taken with jigs and drift gillnets and believed to have some fishery potential because of its abundance.

Local Names : JAPAN: Takoika.

Literature : Okutani (1980); Tomiyama & Hibiya (1978); Nesis & Shevtsov (1977).

Remarks : A closely related species, Gonatopsis octopodatus, occurs in Japanese waters (northwestern Pacific) and it is distinguished by having 8 to 12 rows of minute suckers on the distal 1/3 to 1/4 of the arms.

Gonatus type C Kubodera, 1973

Previously described from individuals of 9-15 mm DML only. Mantle covered by epidermis, but with a broad space between the two layers. Fins small: FLI, 10-13%; FWI, 35-50%. Arms weakly muscled, none yet has hooks. Clubs of larger specimens (over 12 mm DML) with one enlarged sucker; five to six longitudinal rows of small suckers on stalk decreasing to two or three sparse rows basally. See Kubodera (1978) for further details.

Kubodera (1978) collected this type from the western North Pacific and the central southern Bering Sea. My samples included 126 individuals (4-16 mm DML) from 54 midwater hauls (mostly 0-225 m, also 0-400 m and 0-1500 m) in the inshore areas of the California Current system through the Alaska Gyre and Alaska Current and into the southern reaches of the Bering Sea, and as far west as 177°E (Figure 32). Two individuals were collected in a haul at the Subarctic Current - Transition Zone boundary at 47°N, 175°W. My samples thus show an eastern component to the distribution of this species.

Gonatopsis borealis Sasaki, 1923

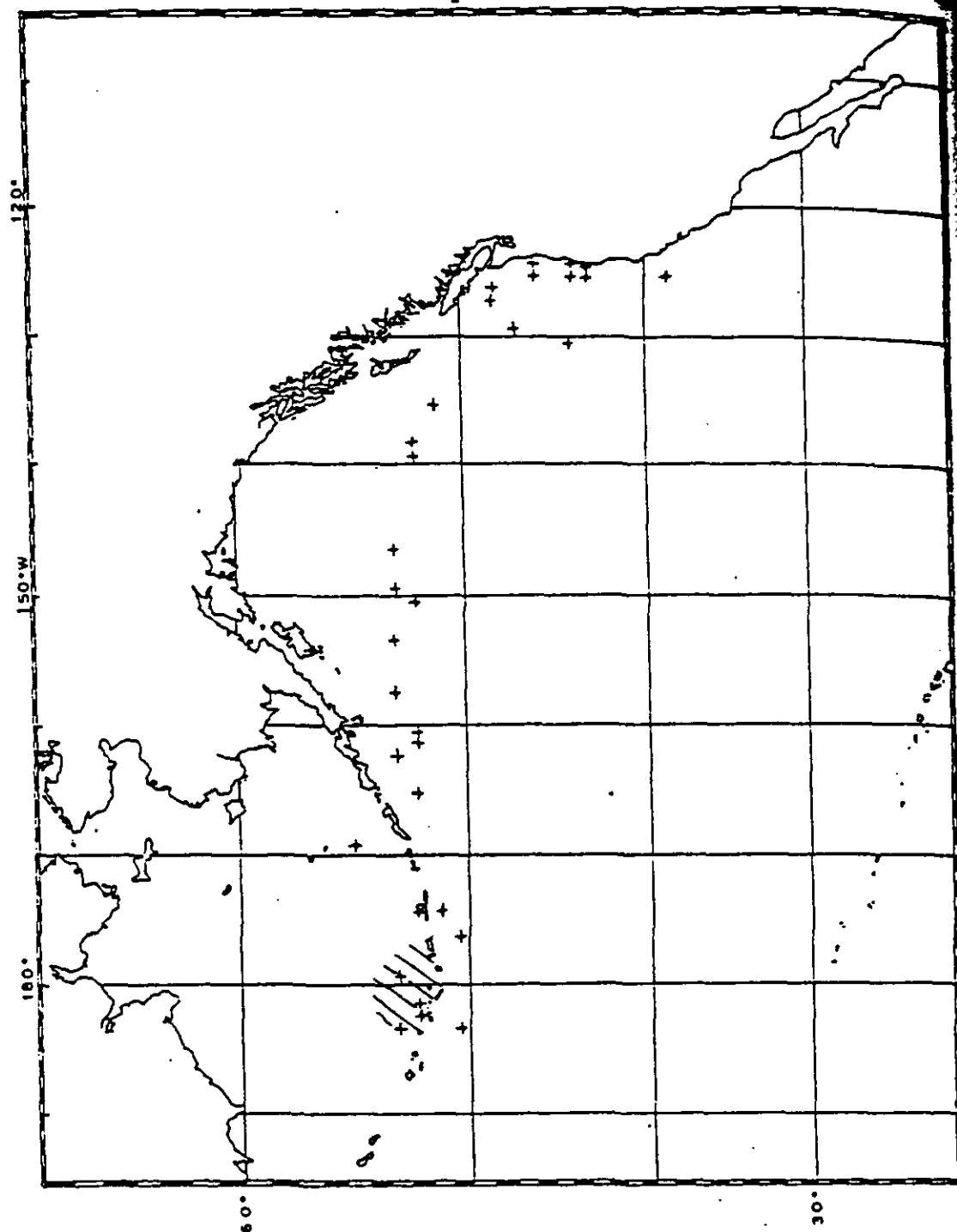
Radula with seven teeth in a transverse row (some other species in this genus have five; this is further discussed in the final section of this thesis). Tentacles absent in adults. Arm tips with quadriserial suckers. Larvae with three enlarged suckers at base of tentacle. See Sasaki (1923, 1929) for further details.

A total of 755 individuals was collected in 401 hauls (14 demersal, 85-650 m, 2600 m maximum; midwater, as deep as 635-720 and 500-1000 m, closed tows; and 0-2600 m, open tows) throughout the California and Alaska Currents, into the southern Bering Sea (Figure 33). There are a few records from transitional waters and even central Pacific waters. Gonatopsis borealis is known from waters across the North Pacific, from southern California (Young, 1972) through Alaskan and Aleutian waters to Japan (Sasaki, 1923, 1929; Akimushkin, 1957; Rice, 1963; Pearcy, 1965; Okutani, 1966; Clarke, 1966; Faculty of Fisheries, Hakodate, 1979, 1980; Fiscus and Mercer, 1982. Also see Figure 9).

This species apparently occurs as two populations - one of small sized individuals with mature gonads, in the Subarctic, and the other, of larger individuals with immature gonads, southeast of the southern and middle Kuriles, and south of the first form in eastern waters (Naito et al., 1977a). Maximum size is 290 mm DML for the female, and 270 mm for the male; longevity is estimated at one year, with growth slowing noticeably after sexual maturity is reached (Naito et al., 1977b).

Okutani (1977) considered this species to be restricted to Subarctic Water. Records from the central and northern Bering Sea (Okutani and Nemoto, 1964; Faculty of Fisheries, Hakodate, 1979, 1980) are probably more accurately referred to Gonatopsis makko, which was not encountered in this study.

Figure 32. Location of hauls capturing Gonatus type C Kubodera, 1978. Previous records in hatched area.



Onychoteuthis borealijaponica Okada, 1927

BOREAL CLUBHOOK SQUID

ONYCHO Ony 2

Onychoteuthis borealijaponica Okada, 1927, Bull.Inst.Oceano, 494:7.

Synonymy : Onychoteuthis banksi Okada, 1927.

FAO Names : En - Boreal clubhook squid
Fr - Cornet boréal
Sp - Luria boreal

Diagnostic Features : Mantle long, slender, muscular (less robust than O. banksi). Fins broad, strong, muscular, their length 55 to 60% of mantle length. A large number of hooks on tentacular clubs (25 to 27). Small, oval photophores on intestinal tract.

Geographical Distribution : North Pacific: Japan to USA (replaces Onychoteuthis banksi in colder, northern Pacific waters).

Habitat and Biology : An oceanic, pelagic species occurring from the surface down to undetermined depths, most abundant in the northwestern Pacific in surface waters of 9 to 13°C. East of Hokkaido, Japan, adults concentrate along the 10°C isotherm.

The population around the Japanese Islands appears to carry out north-south migrations. Juveniles are exclusively encountered in the warm-water area off southwestern Japan (Kuroshio and the countercurrent area), while adults are exploited in the cold-water zones off Hokkaido, further north. In June they arrive on these fishing grounds and remain there until fall. They migrate back southwards, and spawn in medium depths from late autumn through the winter southwest of Japan.

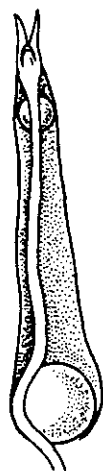
The species preys on small fishes; cannibalism is common.

Size : Maximum mantle length 37 cm in females, 30 cm in males; maximum weight 1.1 kg.

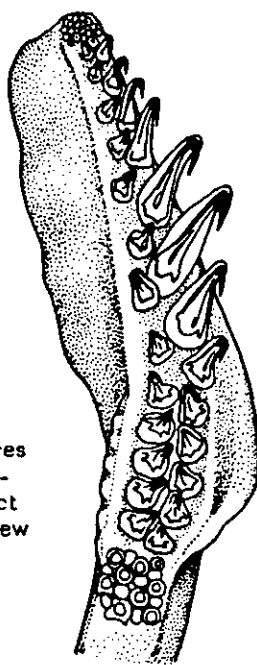
Interest to Fisheries : Following the decline of the yields of Todarodes pacificus this species is being increasingly fished commercially off northwestern Honshu, eastern Hokkaido, and in the northwestern USA, off Washington. It is primarily taken with jigs and drift gillnets. Jigging is particularly successful at night. The photophores make it appear as a dark shadow irradiating pale blue light near the surface. Sometimes it jumps aboard the vessel at night. It has been suggested that it might support commercial fishing operations in the northwestern Pacific north of the subarctic boundary, particularly during late summer and autumn.

Local Names : JAPAN: Tsumeika.

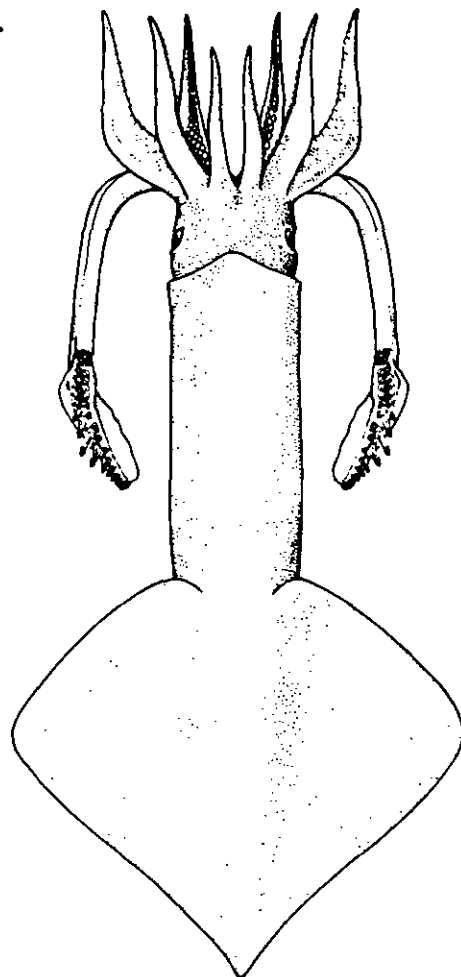
Literature : Murata & Ishi (1977, biology, northwest Pacific); Roberts (1978, resources of New Zealand); Tomiyama & Hibiya (1978); Okutani (1980); Fiscus & Mercer (1982, North Pacific bycatch in surface gillnets); Okutani & Murata (in press); Osako & Murata (in press, fishery).



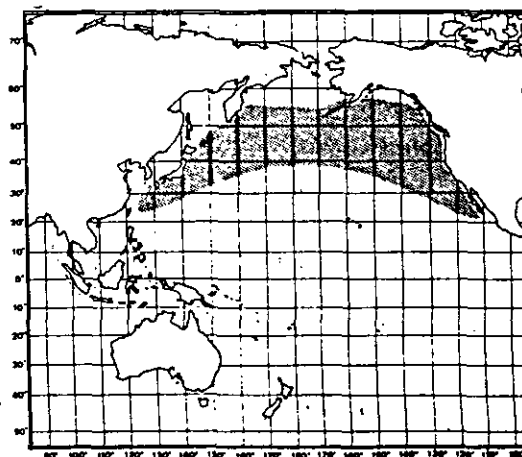
photophores
on intestinal tract
ventral view



tentacular
club



dorsal view



Onychoteuthis borealijaponicus Okada, 1927

Visceral photophores not clearly delineated, and with a band of iridescent tissue between them. Club with twenty-five to twenty-seven hooks.

A total of 231 individuals (0.53% of all cephalopods) was taken in 151 hauls (5.3% of all hauls capturing cephalopods) in the California Current, transitional, and central Pacific waters (midwater, open tows to 3000 m, closed tows as deep as 485-500 m) (Figure 23). Adults of this species are extremely difficult to capture with towed nets; it is probably much more important than the numbers collected would indicate. This species is known to occur in the California Current (Okutani and McGowan, 1969; Young, 1972); southwest of Japan (Okutani, 1969; Yamamoto and Okutani, 1975); and in the Bering Sea (Nesis, 1973b). In the western Pacific, it tends to find a northern limit off the southern Kuriles, in the southern portion of the Subarctic water mass in summer, with a southward migration in the winter (Murata et al., 1976; Murakami, 1976). In 1978 and 1979, T/V Oshoro Maru collected this species in salmon gillnets in an area bounded by 40° and 45°N, and 174° and 179°E (Faculty of Fisheries, Hakodate, 1979, 1980). Fiscus and Mercer (1982) reported gillnet collections in and north of this area (Figure 9).

Naito et al. (1977a) noted that O. borealijaponicus occurred in water temperatures of 1° to 20°C, but abundant catches occurred at 6° to 14°C. They also indicated (1977b) that maximum sizes were 370 mm DML for the female, 300 mm for the male, that the life span

was probably only one year, and that the growth rate decreased rapidly with the onset of sexual maturity.

Fiscus and Mercer (1982) captured this species at water temperatures of 6.9° to 12.8°C, primarily between 9° and 13°C. They postulated maturity for females at DMLs above 290 mm and nidamental gland length over 40 mm, and for males, when spermatophores were present in Needham's sac. They also gave length-weight relationships for animals over 200 mm DML and speculated that individuals mature "in late summer and early fall at about the same rate across the North Pacific."

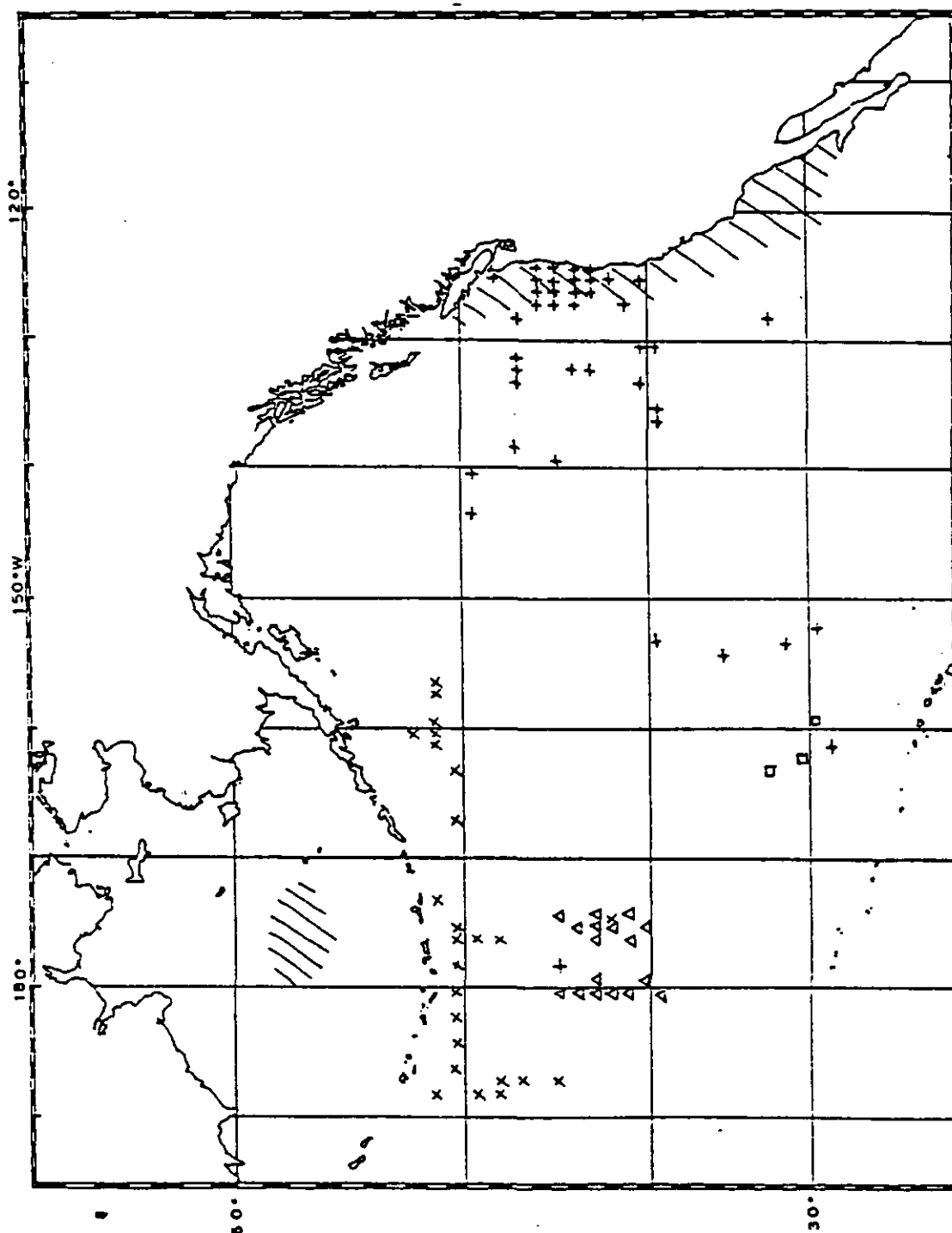
The central Pacific collections of this species are noteworthy in indicating a zoogeographic overlap with *Q. banksii*; Okutani (1981) has noted a similar overlap off Okinawa and Taiwan.

Onykia carribaea LeSueur, 1821

Characterized by tetraserial club armature and the absence of photophores. Very small (37 mm DML maximum known - Lipka, 1975) as adults. The genus may be monotypic.

Four individuals (3, 6, 6, 9 mm DML; OSUI 724-726) were collected in central Pacific waters (midwater tows, 0-170 m) (Figure 24). Hooks are not yet developed on the clubs of these specimens, which demonstrate biserial armature proximally and tetraserial armature distally. This epipelagic species is known circumglobally between about 40°N and 40°S (Clarke, 1966). In the northeastern Pacific, this species has been taken only off southern California and Baja California (Nesis, 1973b). The

Figure 23. Location of hauls which captured Onychoreuthis banksii (squares) and O. borealijaponicus (crosses; triangles represent captures of O. borealijaponicus by T/V Oshoro Maru; other previous records shown as shaded areas; salmon gillnet data represented by x's).



RELATIVE SIZES OF SEABIRDS



STORM-PETREL

*Small
hand size*



ALBATROSS

Large

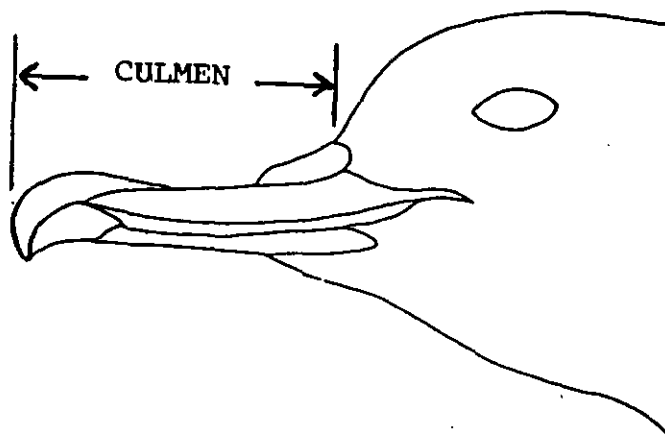


GADFLY PETREL

moderate

SOOTY VERSUS SHORT-TAILED SHEARWATERS

The culmen (length of dorsal surface of bill from feather-bill interface to tip) of short-tailed shearwaters ranges from 29-35 mm whereas the culmen of sooty shearwaters ranges from 38-48 mm.



Key To Identification of Designated Bird Species in Squid Fishery Area
Patrick J. Gould, May 9, 1989.

SPECIES*	BACK	BELLY	BILL	FEET	SPECIAL MARKS
DA (A)	white	white	pink	pale	very large bill.
DA (I)	dark	white	pink	pale	very large bill.
DN	dark	dark	dark	dark	may have white around bill and on rump.
DI	dark	white	grey	pale	bill may tend to yellowish.
FG (D)	dark	dark	yellow	varies	bill short/thick stubby, whitish triangle in outer wing.
FG (L)	gray	white	yellow	varies	bill short/thick stubby, whitish triangle in outer wing.
PS	dark	dark	pale	pale	large bill.
PG	dark	dark	dark	dark	irregular white patches in underwing. Bill and body somewhat larger & heavier than STSH.
ST	dark	dark	dark	dark	underwing uniform silvery, may look white in reflected light.
PB	gray	white	dark	pale	dark cap, dark "M" on top of wings. Bill slender.
LC (A)	dark	dark	red	orange	bill large, triangular.
LC (I)	dark	grey	dark	orange	bill small, almost stubby.
F/C (A)	dark	white	yellow	orange	bill large, triangular, tipped with red.
F/C (I)	dark	white	dark	orange	bill small, almost stubby.
OL	dark	dark	dark	dark	white rump patch.

*: Species arranged from largest to smallest: DA (Short-tailed Albatross); DN (Black-footed Albatross); DI (Laysan Albatross); FG (Northern Fulmar); PS (Flesh-footed Shearwater); PG (Sooty Shearwater); ST (Short-tailed Shearwater); PB (Buller's Shearwater); LC (Tufted Puffin); FC (Horned Puffin); OL (Leach's Storm-petrel).
A = adult; I = immature; D = dark phase; L = light phase.

SEABIRDS

The primary objective of the seabird monitoring program is to obtain accurate information on the species and numbers of individual birds caught in the Japanese squid driftnet fishery. This year's effort represents a pilot program in the squid fishery, the first year in which U.S. observers have been allowed aboard commercial squid vessels. Accuracy is extremely important to enable us to establish the amount of variation in the catch statistics. This information will allow us to design a statistically reliable monitoring program in the future.

Because of the large amount of information that the observers are being asked to collect, the seabird data collection requirements have been simplified as much as possible. Our primary interests in the pilot squid observer program are (1) accurate species identification, and (2) accurate counts of birds caught. We will not require that observers determine age, sex, molt, or breeding condition of the birds, as has been done in previous observer programs.

The agreement with the Japanese on the pilot squid observer program restricts U.S. observers to recording catch data on 11 of the 39 species of seabirds recorded in the vicinity of the squid fishery (Table 1). However, if other identifiable species start showing up in the nets (especially if they are of regular occurrence or involve large numbers) the observer should make a mental note of these occurrences for debriefing at the end of the cruise.

In addition to the standard data recorded at each gillnet set and retrieval, an attempt should be made to collect the following information:

Prior to Set

While enroute to the fishing grounds, or while deploying the nets, it is highly recommended that the observers familiarize themselves with the seabirds associating with the squid fishery by observing birds attracted to the vicinity of the net or catcherboat. This should make it easier for you to identify individual birds as they come up in the nets. You will need a good pair of binoculars (7X 35 at a minimum) and a field guide for these observations. Also, it would be beneficial to familiarize yourself with the species most likely to be encountered by looking at the illustrations and reading the species descriptions in the field guide you were given.

During Retrieval

Seabird entanglements are generally noted as the gillnet emerges from the water just before it comes over the rail. The observer should make every effort to identify each bird to the species level. In many cases, however, it will be impossible to identify birds to specific species. In such cases, it is permissible to record these birds in one of the "unidentified" categories (e.g., unidentified shearwaters). If a bird cannot be identified to species or species group, then record it as "unidentified bird," but try to use this category sparingly as it is not very informative. If time allows, try to jot

down distinctive features of the unidentified birds to aid in possible future identification.

Each bird entangled in the net should be classified as either "dead," "released alive," or "lost" per the definitions provided.

Note the time of each entanglement event and record in the log book. Each seabird entanglement should be considered a separate event unless two or more birds come up less than a minute apart (e.g., "0715 two sooty shearwaters, 2 m apart, both dead").

RELEASED ALIVE: Record the species and condition of all living birds that escape from the net or are released (e.g., good condition, waterlogged and poor condition, injured from net, unable to fly, etc.). Record data in your waterproof notebook and summarize on the retrieval form.

LOST: Remember to look carefully for dead seabirds that drop out of the net and are lost. Identify these birds as closely to species as possible as the net rises from the water towards the rollers. Record this data in your logbook and summarize it on the retrieval form.

After Retrieval

THESE PROCEDURES WILL BE FOLLOWED ONLY IF ALL BIRDS CAUGHT IN THE GILLNETS ARE SET ASIDE BY THE JAPANESE FISHERMAN AND YOU ARE ALLOWED ON THE WORK DECK AFTER THE NET RETRIEVAL IS FINISHED.

Sort birds into species groups, and count all birds of each species caught. This will allow you to double-check the accuracy of the data recorded during the net retrieval. It will also provide your best opportunity to accurately identify similar species such as sooty and short-tailed shearwaters. You may find the "Beached birds identification manual" very useful for this purpose. Summarize this information in your waterproof notebook and on your retrieval forms. Make sure you include birds the Japanese may have thrown overboard in your totals.

After All Data On Retrieval Have Been Recorded In Log Book

Transfer data for the set from log book to computer-coded retrieval forms. Use one line on the form for each species recorded during the retrieval. There is one exception to this: if you recorded 100 or more birds of a species in one of the categories (dead, lost, or alive) there will not be room in the two digit column. List 99 on one line and the remainder on the next line with the same species information and set information.

Data to be Returned to U.S. Fish and Wildlife Service

1. Retrieval forms with numbers and species of birds dead, lost and alive.
2. Data tables for each set.
3. Waterproof notebooks with raw data.

Table 1. List of seabird species (1) known to be present in the squid fishery during summer and fall, (2) known to be attracted to the squid gill-net retrievals, (3) known to be caught in squid gill-nets, and (4) authorized to be recorded in the 1989 squid pilot observer program.

Common Name (Scientific Name)	Status	Species Code
Common Loon	1	
Short-tailed Albatross (<i>Diomedea albatrus</i>)	1 2 4	DA
Black-footed Albatross (<i>Diomedea nigripes</i>)	1 2 3 4	DN
Laysan Albatross (<i>Diomedea immutabilis</i>)	1 2 3 4	DI
Northern Fulmar (<i>Fulmarus glacialis</i>)	1 2 4	FG
Dark-rumped Petrel	1	
White-necked Petrel	1 2	
Mottled Petrel	1 2	
Solander's Petrel	1 2	
Kermadec Petrel	1	
Herald Petrel	1	
Cook's Petrel	1 2	
Stejneger's Petrel	1	
Pycroft's Petrel	1	
Bonin Petrel	1 2	
unidentified gadfly-petrel	1	
Bulwer's Petrel	1	
Flesh-footed Shearwater (<i>Puffinus carneipes</i>)	1 2 3 4	PS
Buller's Shearwater (<i>Puffinus bulleri</i>)	1 2 3 4	PB

Sooty Shearwater (<i>Puffinus griseus</i>) <small>UNIDENTIFIED SHEARWATER</small>	1	2	3	4	PG
Short-tailed Shearwater (<i>Puffinus tenuirostris</i>) <small>UNIDENTIFIED SHEARWATER</small>	1	2	3	4	ST
Unidentified dark shearwater	1	2	3	4	UT
unidentified procellariid	1				
Fork-tailed Storm-Petrel	1	2			
Leach's Storm-Petrel (<i>Oceanodroma leucorhoa</i>)	1	2		4	OL
Band-rumped Storm-Petrel	1	2			
unidentified dark storm-Petrel	1	2			
Sooty Storm-Petrel	1	2			
White-tailed Tropicbird	1				
Red-tailed Tropicbird	1				
Red-necked Phalarope	1				
Red Phalarope	1	2			
unidentified phalarope	1				
Pomarine Jaeger	1	2			
Parasitic Jaeger	1	2			
Long-tailed Jaeger	1	2			
unidentified jaeger	1				
South Polar Skua	1	2			
Glaucous-winged Gull	1				
Black-legged Kittiwake	1	2			
Common Tern	1				
Arctic Tern	1				
unidentified murre	1				
Cassin's Auklet	1				

Tufted Puffin (Fratercula cirrhata)	1	3	4	LC
Horned Puffin (Fratercula corniculata)	1	3	4	FC
unidentified bird	1	3		UB

SUB-ARCTIC BIRDS -- DIVE & PURLOE
SUB-TROPICAL BIRDS -- FLOAT & DAB

Their distribution is determined by OCEANIC CURRENTS --> TEMPERATURE & SALINITY

ADDENDUM TO "CHECKLIST OF SEABIRDS MOST LIKELY TO BE SEEN AND/OR ENTANGLED IN THE JAPANESE HIGH SEAS SALMON FISHERY DURING JUNE-JULY IN THE NORTHWEST PACIFIC"

Please note that the checklist was compiled for the salmon gillnet fishery. In relation to the high seas squid driftnet fishery, the salmon fishery was (1) much further north and in colder waters, and (2) much closer to land, i.e., the Aleutian islands. Keep in mind that there will be a large difference in the species of seabirds you will observe. For example, species such as the pigeon guillemot and the various auklets and murrelets will be extremely rare, as we will be outside their geographical range.

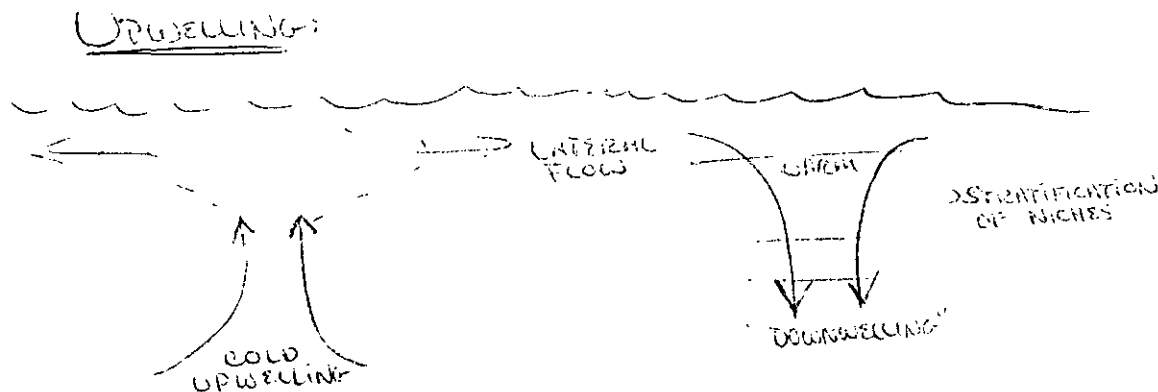
Some additional comments:

SHORT-TAILED ALBATROSS -- again, extremely rare. The brown juveniles resemble color stages of the black-footed albatross.

BLACK-FOOTED ALBATROSS -- common, large numbers may aggregate near the net during retrieval. Mixed aggregations of Laysan and black-footed albatrosses may occur during retrieval.

NORTHERN FULMAR -- not as common as seen during the salmon gillnet fishery.

SHORT-TAILED SHEARWATER and SOOTY SHEARWATER -- Both species occur with some frequency in the area of the high seas driftnet fishery. Positive identification to species is possible only by measuring culmen-length.



CHECKLIST OF SEABIRDS MOST LIKELY TO BE SEEN AND/OR INCIDENTALLY ENTANGLED IN
THE JAPANESE HIGH SEAS SALMON FISHERY DURING JUNE-JULY IN THE NORTHWEST PACIFIC

- SHORT-TAILED ALBATROSS -- extremely rare. Most sightings are brown juveniles.
Look for it especially around the mothership.
- BLACK-FOOTED ALBATROSS -- uncommon. usually no more than one seen at any one time.
You might see a total of 10 during the season.
- LAYSAN ALBATROSS -- common. The common black & white albatross which will be
seen during every gillnet retrieval. Maximum numbers
may reach 100 around the mothership.
- * NORTHERN FULMAR -- abundant. The most ubiquitous occurring seabird on the fishing
grounds. They are everywhere. Dark and light forms.
- MOTTLED PETREL -- uncommon. Usually occurring as singles or in small flocks of less
than 10. Please retain any specimens taken in gillnets.
- * SHORT-TAILED SHEARWATER -- abundant. Often seen in large flocks of 500+. The
most common species taken in gillnets.
- SOOTY SHEARWATER -- rare? Doubtfully occurs on the fishing grounds at least during
June-July. Larger than Short-tailed, bright whitish to
silver wing linings, heavier bill. Please retain any
suspected specimens taken in gillnets for verification.
- * FORK-TAILED STORM PETREL -- common FCZ-S, uncommon FCZ-N. Occasionally taken in
gillnet, usually floatline.
- * LEACH'S STORM PETREL -- common FCZ-S, rare FCZ-N. Shyer than Fork-tailed but as
equally common although much less often taken in nets.
- RED PHALAROPE -- uncommon to common thru July only. Usually seen in little rafts
strung out along the floatline during retrievals. This
is a small migrant ocean going 'sandpiper' no larger
than a robin.
- SOUTH POLAR SKUA -- extremely rare. a migrant from Antarctica most likely to be
seen around the mothership.
- POMARINE JAEGER (SKUA) -- uncommon. Usually seen in singles or pairs seldom lingering
around catcherboats. Small groups often near mothership.
- PARASITIC JAEGER (SKUA) -- uncommon. Usually seen in singles or pairs. Seldom
lingers around catcherboats. Small groups near mothership.
- LONG-TAILED JAEGER (SKUA) -- uncommon. Usually seen in singles or pairs. Seldom
lingers around catcherboats. Often near mothership.
- * GLAUCOUS-WINGED GULL -- common near islands uncommon offshore. The only large
white 'sea gull' usually seen in the area. Occasionally
taken in gillnets. Beware of adults and immatures.

- * BLACK-LEGGED KITTIWAKE -- common, especially around mothership. However, population varies from year to year. Occasionally taken in gillnets. Beware of adults and immatures.
- RED-LEGGED KITTIWAKE -- uncommon to rare. Tends to fly higher and more direct than Black-legged. Has darker mantle and conspicuous red legs. Population varies from year to year.
- DOVEKIE -- extremely rare. Probably very unlikely. One specimen taken in gillnets over the years. Please retain any others for documentation.
- * THICK-BILLED MURRE -- common. Increasingly common nearer the islands. Small numbers taken throughout the season.
- * THIN-BILLED (COMMON) MURRE -- common. Increasingly common nearer the islands. Small numbers taken throughout the season.
- PIGEON GUILLEMOT -- common near-shore, extremely rare more than 5 miles from shore. Please retain any specimens taken in gillnets.
- MARbled MURRELET -- extremely rare more than 5 miles from shore, uncommon near islands. Retain all specimens taken in gillnets.
- KITTLITZ'S MURRELET -- extremely rare more than 5 miles from shore. Please retain all specimens taken in gillnets.
- * ANCIENT MURRELET -- common. Small numbers taken throughout the season. Watch for tiny downy chicks far far from shore during July.
- * CASSIN'S AUKLET -- uncommon. Small numbers taken through the season.
- * PARAKEET AUKLET -- uncommon. Small numbers taken throughout the season.
- * CRESTED AUKLET -- uncommon offshore, but can be locally abundant near the islands. Small numbers taken throughout the season, but if sets are near the islands (Agattu), takes of up to 500 in a single set have occurred.
- WHISKERED AUKLET -- extremely rare beyond tide rips near the islands. Please retain all specimens taken in gillnets. Carefully compare with Crested Auklet.
- * LEAST AUKLET -- uncommon. Small numbers taken throughout the season.
- * HORNED PUFFIN -- common. Small numbers taken throughout the season. Watch for juveniles in July.
- * TUFTED PUFFIN -- common. Small numbers regularly taken throughout the season. Watch for 'flightless' juveniles in July.

NOTE: This list is incomplete. For 'hard core' birders, there are migrant songbirds, shorebirds, waterfowl, and vagrant siberian gulls and terns to be occasionally seen. Note also that species on this list indicated with an asterisk (*) are those most often incidentally taken in gillnets.

PACIFIC ALBATROSSES

43 SHORT-TAILED ALBATROSS 89/221cm

other: Steller's Albatross
Diomedea albatrus NPO

MAP 43 Text page 226

43a ADULT: Largest and only white-bodied albatross of the N. Pacific.

43b JUVENILE (FIRST STAGE): Closely resembles smaller juvenile Black-footed Albatross (44c). Differs in large pink bill, pale legs and lack of white at base of bill.

43c JUVENILE (SECOND STAGE): As 43b but whitish chin divided from buff-brown or off-white underparts by conspicuous dark collar. Thumb nail shows start of diagnostic white upperwing patches, which, combined with pink bill and feet, are excellent in-flight characters never found in any stage of 44 below.

43d IMMATURE (FIRST STAGE): Plumage generally whiter; head shows conspicuous white forehead and dark cap. Upperwing mostly sepia-brown, but note start of second white patch.

43e Underwing-coverts begin to show whitish tips at this stage.

43f IMMATURE (SECOND STAGE): Some may breed in this plumage. Dark cervical collar combined with whitish body and white upperwing patches produces distinctly different appearance from any stage of 44 below.

43i SUB-ADULT: Resembles adult but with brownish cervical collar; corresponding white areas variably suffled with brownish tips.

44 BLACK-FOOTED ALBATROSS 71/203cm

Diomedea nigripes NPO

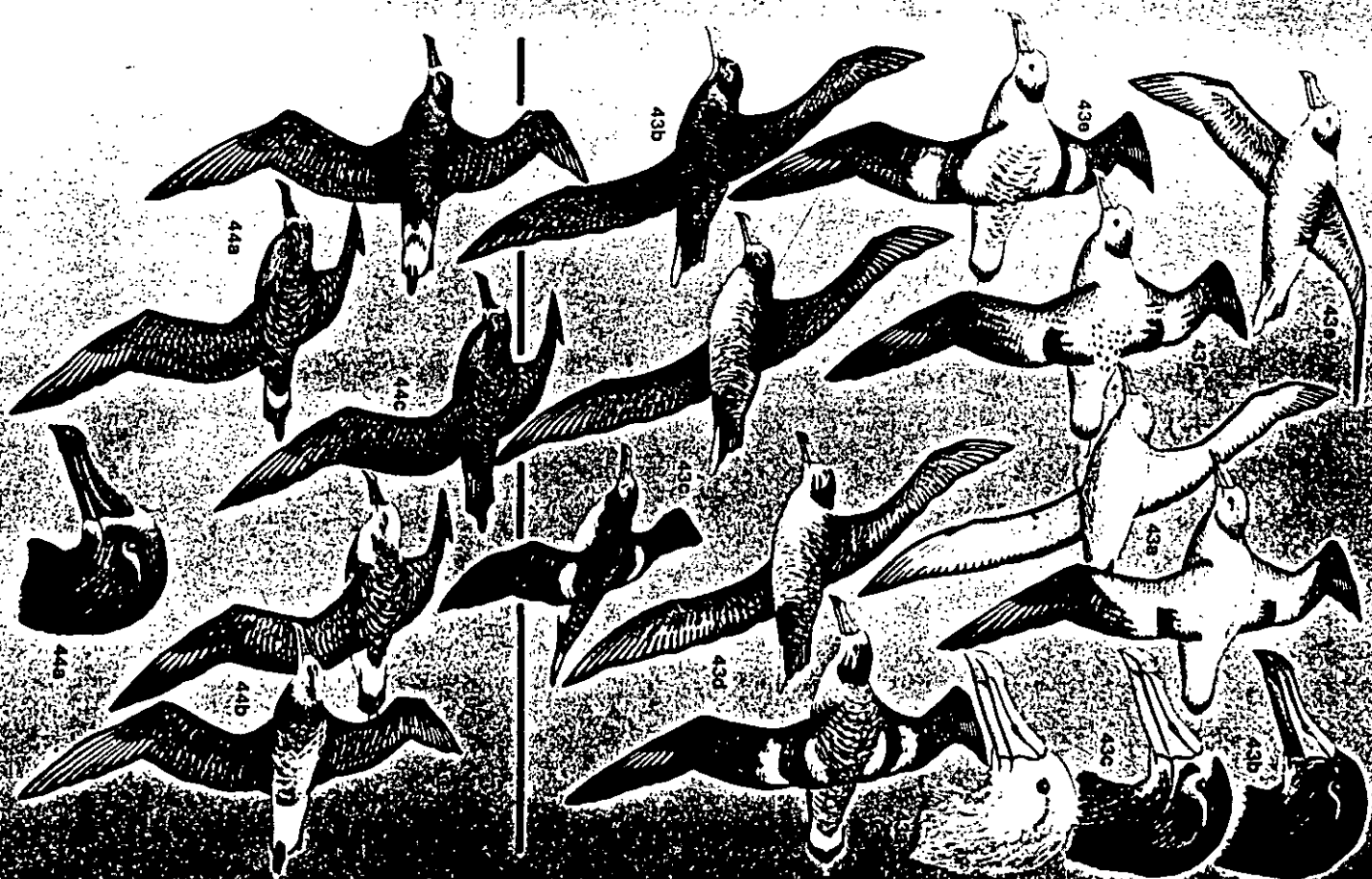
MAP 44 Text page 227

NOTE: Plumage sequences poorly understood and complicated by some variance in colour of uppertail-coverts, ventral area and undertail-coverts of adult.

44a ADULT: Mostly dusky-brown except narrow whitish area at base of bill, over base of tail and, normally, whitish undertail-coverts and ventral area.

44b ADULT (aberrant or aged): Superficially resembles 'immature' stages of Short-tailed Albatross but bill and legs darker, size smaller. Head lacks conspicuous dark cervical collar or golden hue, and wings, whilst paler than in typical form, lack diagnostic white patches found in the Short-tailed Albatross.

44c JUVENILE: Bill and legs dark. Plumage wholly sooty-brown except for faintly white area at base of bill. See 43b above.



43 SHORT-TAILED ALBATROSS

other: Steller's Albatross
Diomedea albatrus

PLATE 16 Figs 43a-43i

MAP 43

Length 84-94cm (33-37in.), wingspan 213-228cm (84-90in.), iris blackish. Bill pink, blue at tip, with narrow black line at base extending along gape. Legs/feet bluish-white, can appear dark grey at sea.

N Pacific: formerly widespread, now rarest of all albatrosses. Range overlaps with Black-footed Albatross (p. 227), care needed to separate from juveniles and old/aberrant birds of that species. Morphology resembles that of Wandering Albatross (p. 222). Sexes alike, no seasonal variation. Juveniles and immatures separable but Tickle (1973) has shown that some breed in so-called immature plumage, birds becoming progressively whiter with age. For convenience, the terms 'immature' and 'sub-adult' have been retained in the following entry, much of which is based on Hasegawa (pers. comm.) and Yanagisawa (1973).

JUVENILE (FIRST STAGE): Bill and legs pale flesh. often appearing whitish at long range. Head, Body, Wings and Tail wholly blackish-brown except for paler chin and narrow line below eye.

JUVENILE (SECOND STAGE): As first stage except: Head Forehead, base of bill and chin whitish, extending under and behind eye as narrow streak; ear-coverts and lores paler and greyer. Throat remains dark, forming noticeable collar. Body Underparts dark buff-brown wearing to off-white on centre of breast and belly; flanks, thighs and ventral area remaining dark. Wings Upperwing shows first signs of diagnostic whitish patch on inner greater coverts, an excellent in-flight character.

IMMATURE (FIRST STAGE): Bill and legs as adult. Head White except for sepia-brown hindcrown, nape, hindneck and sides of neck. Body Upperparts mainly sepia-brown, scaled buff and white; rump and upper tail-coverts whitish. Underparts off-white except for brownish sides of breast and molting along flanks, thighs and ventral area. Wings Upperwing mostly sepia-brown with two diagnostic whitish patches, one on innermost greater coverts, the other adjoining scapulars. Underwing mostly brown, primary-coverts whitish, remainder of coverts variably tipped with white. Tail Blackish, base white.

IMMATURE (SECOND STAGE): Head Mostly white, crown and sides of face washed yellow; nape brown, forming partial cap and collar. Body Upperparts whitish, lightly scaled buff. Underparts mostly white, flanks, thighs and ventral area faintly brown. Wings Upperwing: whitish patches larger. Underwing becoming progressively whiter. Tail As adult.

SUB-ADULT: Head Resembles adult except for brownish cervical collar. Body and Wings As adult but rather dingy with variable buffish feather tips. **ADULT:** Head Mostly white with yellow cast on crown extending, in some, from nape across throat to form continuous collar. Body Wholly white. Wings Upperwings: mostly white; primaries, their coverts, secondaries and tertials black (extent of black varies individually). Underwing mostly white with narrow black margins; inner coverts and axillaries variably streaked greyish-brown. Tail Black, base white.

FHJ: Largest N Pacific albatross; jizz recalls Wandering Albatross (p. 222) but smaller, proportionally shorter wings. Larger size and massive pink bill enable separation between juveniles of this and of Black-footed Albatross (p. 227). Not normally attracted to ships, apparently timid at sea.

DM: Formerly abundant in N Pacific, where bred within Bonin, Izu, Senkaku, Pescadore and Daito groups. Pelagic range extended from Japan and coasts of China E to Bering Sea and western coasts of N America. Brought to verge of extinction by Japanese plume-hunters in late 19th and 20th centuries; reduced to about ten pairs by 1953, has since increased slowly. Tickle estimated about 57 pairs in 1973 but Hasegawa (pers. comm.) estimated 1982 population at 250 birds. Only definite breeding site now at Tori Shima, a volcanic island some 360km S of Tokyo. Recently suspected of breeding at Minami Kojima in the Senkaku Raito (25°45'N, 123°36'E) but reports yet to be confirmed. Returns to colonies Oct: egg-lays Oct-Nov; fledging May onwards. Now only rarely reported away from natal island but formerly dispersed into Pacific following tradewinds N to Bering Sea, E and S past California and then westwards back to natal islands. Stragglers occasionally occur at Hawaiian group in Leeward Is.; one has been at Midway for about six years (Warham, pers. comm.). Recent status of western N America summarised by Robertson (1980), who listed six records of Alaska: one record each from British Columbia and Oregon; two records from California. Most occur, red Jun-Nov.

SS: Juveniles closely resemble juvenile Black-footed Albatrosses (p. 227) but differ in massive pink bill, pinkish legs, lack of white at base of bill and in larger size. All subsequent stages would differ from aberrant Black-footed or Black-footed x Laysan hybrids by distinctive white patches on upperwings which become progressively larger with age. See notes under old/atypical Black-footed Albatross (p. 227). Morphology similar to Wandering Albatross, which has occurred in N Pacific but has undergone white with black margins at all ages (juvenile and immature Short-tailed have dark underwings). Adults of the two species differ in head colour, upperwing and tail patterns.

44 BLACK-FOOTED ALBATROSS

Diomedea nigripes

PLATE 16 Figs 44a-44c

MAP 44

Length 66-74cm (27-29in.), wingspan 193-213cm (76-84in.), iris blackish-brown. Bill colour varies: dark chestnut with blackish base and nail to (more usually) wholly glossy, blackish-grey. Legs/feet black.

N Pacific Ocean: easily separated from Laysan Albatross (p. 227) but confusion always possible with juvenile or immature Short-tailed (p. 226). Latter differs mainly in size, bill and leg colour and, in subsequent stages, upperwing pattern. Sexes alike, males average slightly larger; no seasonal variation although old or perhaps aberrant birds show almost white head and paler plumage. Juveniles separable but complicated by incomplete knowledge of plumage stages and by some variation in colour of upper tail-coverts and ventral areas of many adults. Black-footed x Laysan hybrids recorded; Warham (pers. comm.) reported at least five at Midway in 1960/61 season.

JUVENILE: Bill and legs blackish. Plumage wholly sooty-brown except for whitish area at base of bill. **IMMATURE:** As juvenile except: Body Upperparts coverts tipped whitish, sometimes forming indistinct horseshoe over tail; under tail-coverts vary from grey to white.

ADULT (typical): Head Mostly blackish-brown or greyish-brown, except for narrow whitish area around base of bill and under eye (some lack this). Body Upperparts mainly blackish-brown, often with mauve cast; indistinctly fringed buff-grey but soon wearing to even colour; rump and upper tail-coverts usually white. Underparts slightly paler, some showing white under tail-coverts and ventral area. Wings As upperparts, outer primary shafts white. Tail Blackish-brown.

ADULT (aberrant or aged): Often mistaken for white. Tail Blackish-brown.

45 LAYSAN ALBATROSS

Diomedea immutabilis

PLATE 15 Fig. 45

MAP 45

Length 79-81cm (31-32in.), wingspan 195-203cm (77-80in.), iris dark, white lower lid. Bill varies: light grey with darker tip and base or yellowish with grey tip. Legs/feet flesh-pink

Northern Pacific Ocean: the only dark-backed albatross of the region with white head and underparts. Sexes alike, no seasonal variation. Juveniles barely separable (hence *immutabilis*), although bare parts probably greyer. Albinism and hybrid Laysan x Black-footed Albatrosses reported (Palmer 1962; Fisher 1972; Warham, pers. comm.).

PLUMAGE: Head Mainly white, lores dark grey or black, sides of face often grey (at close range). Body Upperparts: mantle, scapulars and back blackish, rump white. Underparts white or yellowish-white. Wings Upperwing blackish above, primary shafts white; browner in worn plumage. Underwing mainly white with narrow, irregular margins broadest at carpal and primary tips; white coverts show irregular blackish streaks (varies individually). Tail Greyish.

FHJ: The only dark-backed albatross regularly occurring in N Pacific with white head and underparts. Occasionally follows ships. Appearance resembles Southern Oceans mollymawks but, unlike that group, feet project slightly beyond tail in flight. **DM:** Although formerly widespread throughout N Pacific, numbers decimated in early part of 20th

century and during Second World War when some colonies exterminated. Until recently known to breed only in central Pacific on northwest Hawaiian chain, mainly at Laysan, Midway, Lisianski Is., Pearl and Hermes Reel. See Palmer (1962) for minor breeding stations. Has recently nested at Kilauea Point, Kauai, Hawaii. Kurata (in Hasegawa 1978) recently reported breeding south of Japan at Bonin Is., the only modern record of breeding away from Hawaiian chain. Returns natal islands Oct onwards; egg-lays Nov/Dec; fledging May. Rarely seen off breeding stations during summer. Post-breeding range E to North America, where regular but scarce off California and Washington; occurs N to Aleutians and W to Japan. Southern limits of pelagic distribution poorly known. Non-breeders scattered over N Pacific throughout year.

SS: Although most abundant N Pacific albatross, scarcer off western N America than wholly dark Black-footed Albatross. Adult Short-tailed has white back: see under that species (p. 226) for differences at other plumage stages.

Plate 28

LARGER SHEARWATERS AND PETRELS

102 BULLER'S SHEARWATER 46/97cm
other: New Zealand/Grey-backed Shearwater*Puffinus bulleri* PO

MAP 102 Text page 260

102 Large, slender-bodied shearwater with striking upperparts pattern; unlike any other Pacific shearwater. Beware of *Pterodroma externa* group (p. 246).

92 GREY PETREL 48/120cm
other: Brown Petrel, Peduncled, Great Grey Shearwater*Procellaria cinerea* SO

MAP 92 Text page 254

92 Large; combination of ash-brown upperparts and white underparts with grey underwings and undertail-coverts diagnostic. See also Cory's Shearwater, Atlantic and White-headed Petrels (p. 257, p. 240, p. 238).

93 WHITE-CHINNED PETREL 55/140cm
other: Shoemaker/Cape Hen*Procellaria aequinoctialis* SO

MAP 93 Text page 255

93a *P. a. aequinoctialis*: Large, blackish-brown petrel; unmarked ivory-coloured bill and whitish chin diagnostic. Readily identifiable throughout most of range, but beware of 95 in Australasian region.

93b *P. a. conspicillata*: Southern Atlantic; differs in more extensive white on sides of face.

95 WESTLAND PETREL 51/137cm
other: Westland Black Petrel*Procellaria westlandica* RR

MAP 95 Text page 256

95 Resembles 93a in all respects except for black tip to bill; obviously this is hard to ascertain at sea. Parkinson's Petrel (p. 255) is smaller with more delicate bill.

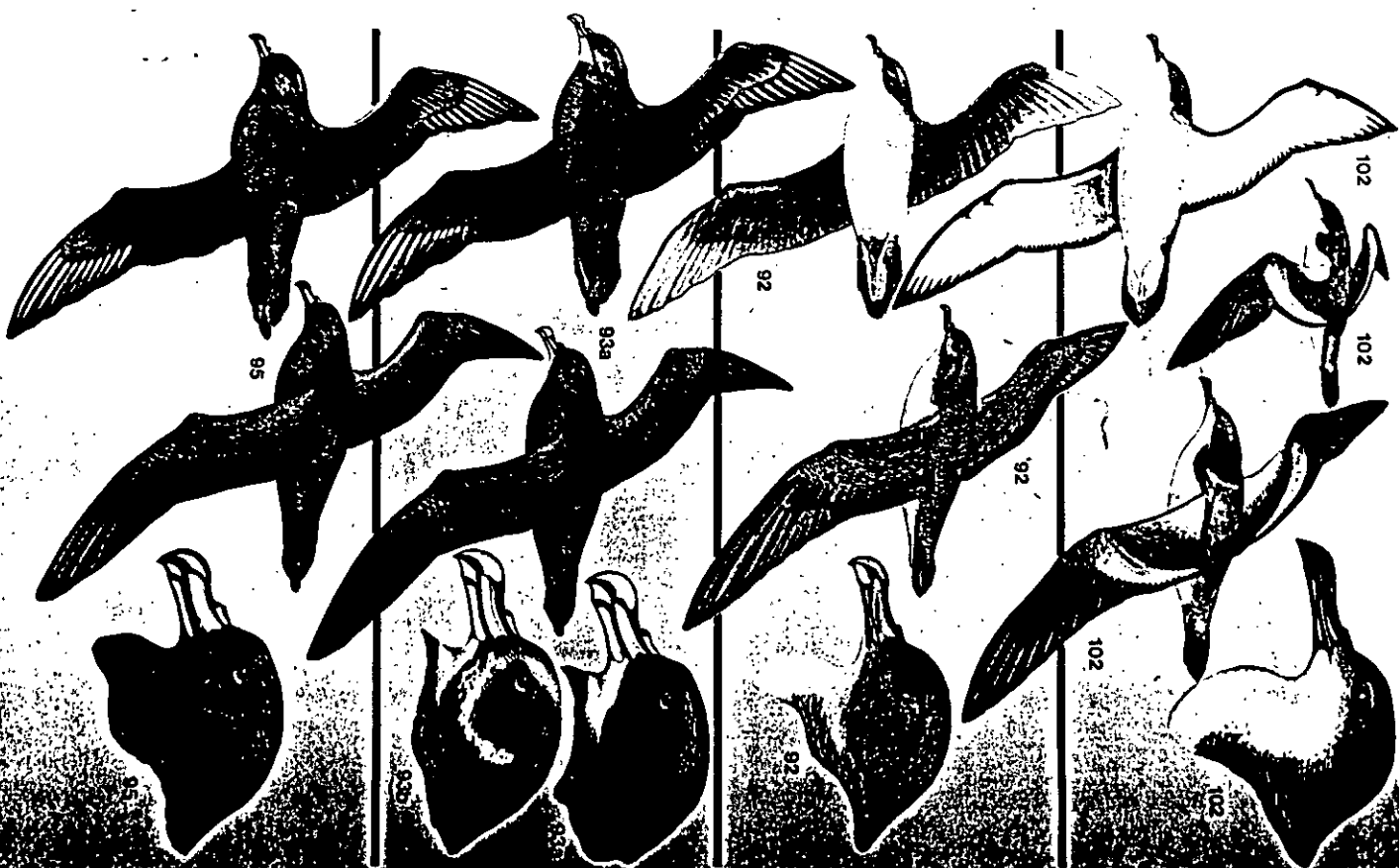


Plate 30

DARK SHEARWATERS

99 FLESH-FOOTED SHEARWATER 43/103cm

other: Pale-footed Shearwater
Puffinus carneipes PO. 10

MAP 99 Text page 258

99 Large, wholly blackish-brown shearwater slightly larger than 101 below; wings held straighter, not bowed and well forward. In good light, bases of primaries on underwing silvery (Fig. 8, p. 259). Bill colour diagnostic.

101 WEDGE-TAILED SHEARWATER 43/101cm

Puffinus pacificus TPO. T10

MAP 101 Text page 259

101a DARK MORPH: Large, wholly blackish-brown shearwater with distinctive buoyant flight: broad-based wings held bowed and well forward. Wedge-shaped tail often hard to discern at sea except when fanned, but appears longer-tailed than 99.

101b PALE MORPH: Paler brown above; underparts and underwing mostly white; sides of breast, flanks, inner underwing-coverts and underail coverts mottled with brown.

101c DARK MORPH (worn plumage): Upperwing coverts paler forming pale bands across inner wing.

103 SOOTY SHEARWATER 44/99cm

Puffinus griseus PO. AO, SO

MAP 103 Text page 260

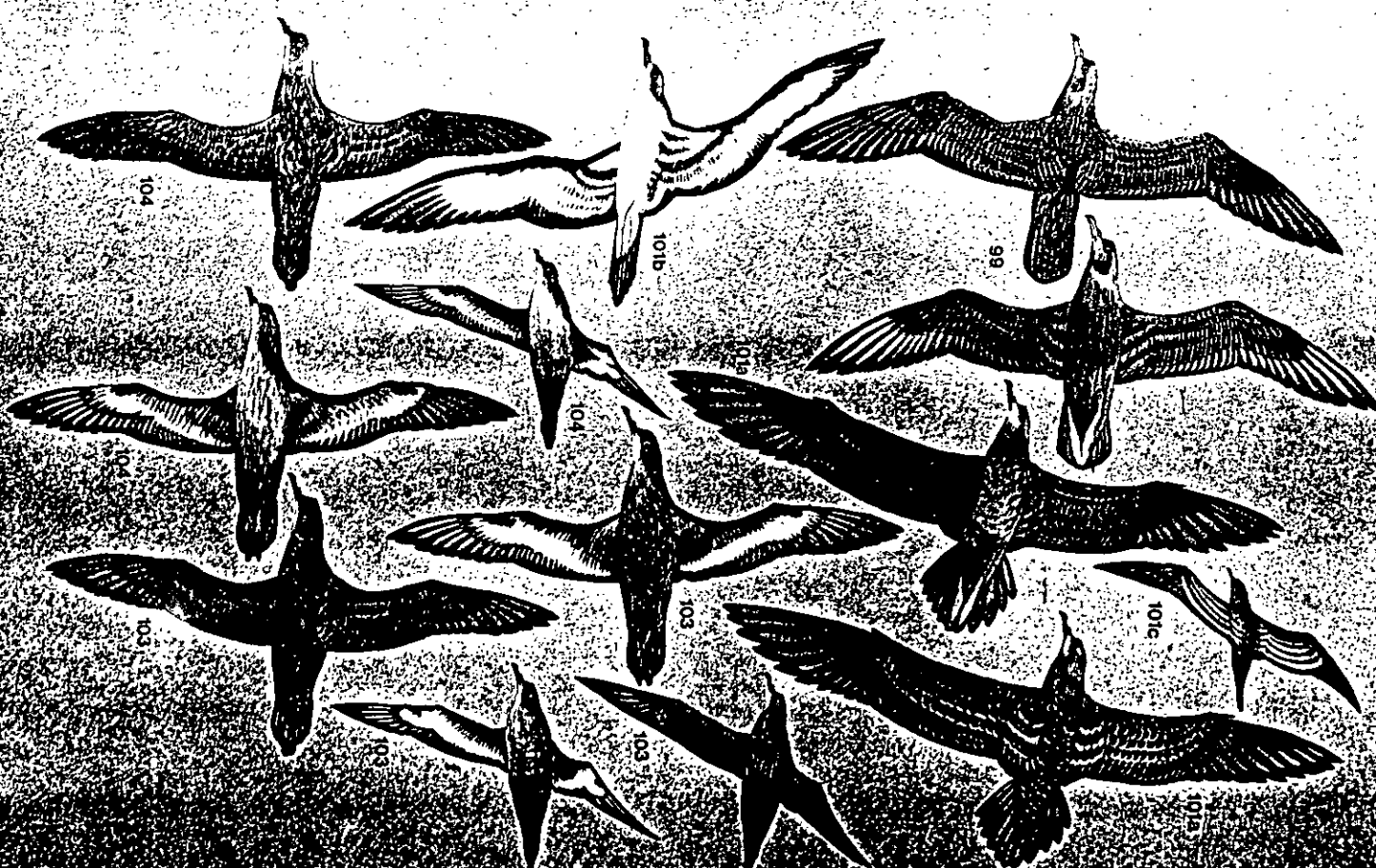
103 Medium-sized, sooty-brown shearwater with white underwing, variable in extent, normally appearing as a white flash when at distance. Wings proportionately long, rather narrow and swept back, contrasting with small head and heavy body. Flight swift, wing action stiff, often fast.

104 SHORT-TAILED SHEARWATER 42/98cm

other: Slender-billed Shearwater
Puffinus tenuirostris PO

MAP 104 Text page 261

104 Closely resembles 103, slightly smaller size apparent only if seen together. Underwing normally greyer without white coverts but variable. Main distinction is shorter bill. In winter quarters some short-tailed appear to have indistinct caps, whitish chins and average darker, more velvety-brown on upperparts than 103.



subspecies, although some authors consider *creolepatus* a southern form of Flesh-footed Shearwater (p. 259).

PLUMAGE: Head Mostly greyish-brown, merging into whitish chin and throat. Body Upperparts uniform grey-brown. Underparts mainly white; flanks and undertail-coverts molted brownish. Wings Upperwing mostly uniform grey-brown; primaries and secondaries darker. Underwing: coverts molted grey and white, with broad, ill-defined dark margins and tip. Tail Blackish-brown. NOTE: Extent of molting on underwing and flanks variable.

FMJ: Large, variably plumaged species. Flight languid and unhurried with slow wingbeats interspersed with low glides; in high winds swifter and stronger, banking in high broad arcs. Solitary or gregarious, often with other migratory species; prefers shallow shelf water.

99 FLESH-FOOTED SHEARWATER

other: Pale-footed Shearwater
Puffinus carneipes

Length 41–55cm (16–18in). Wingspan 99–106cm (39–42in). Iris brown. Bill pale horn, culmen and tip black. Legs/feet flesh-pink.

Indian and Pacific Oceans; range overlaps with Wedge-tailed Shearwater and Parkinson's Petrel (p. 259, p. 255). Sexes alike; no seasonal variation. Adults and juveniles alike. No subspecies. Considered conspecific with Pink-footed Shearwater (p. 257) by some authors.

PLUMAGE: Head and Body Wholly brownish-black. Wings Similar, but blackish primaries on upperwing form dark 'triangles' at wingtips in good light. Underwing mostly very dark brown; in good light bases of primaries silvery (see Fig. 8, p. 259).

FMJ: Large, broad-winged species resembling Pink-footed Shearwater in jizz. Flight progression slow, unhurried, long glides on stiff wings broken by slow effortless flaps, wings rising and falling well above and below body. In higher winds flight assumes typical shearwater careening. Dives well; also feeds by skimming surface with pink feet extended to tread water between shallow belly-flaps; often gregarious at sea.

DM: Trans-equatorial migrant with populations in two main localities, migrating to separate regions. In SW Pacific Ocean breeds Lord Howe I., and offshore islands of New Zealand from Hen and Chickens to Cook Strait. Returns to colonies late Sep; egg-lates Nov/Dec; fledging and departure

DM: Eastern Pacific: breeds Mocha and Juan Fernandez Is off Chile. Returns to colonies Nov/Dec; egg-lates Dec/Jan. Fledging and dispersal begins Mar/Apr; birds moving N along western coasts of South America towards North America. Present off California and Oregon Apr–Nov, some moving N to Gulf of Alaska; peak figures occur from late Jul to late Oct, only a few remaining during winter months. Stragglers W to Hawaiian and Line Is.

SS: Beware double dark morph Northern Fulmar (p. 235) off NW America. On migration present species' range overlaps with Wedge-tailed Shearwater (p. 259); beware especially pale morph of Western Mexico, very similar in appearance including variable molting on underwing-coverts and flanks; present species much heavier and broader-winged with more lumbering flight (Stallcup, pers. comm.). See also Black-vented Shearwater (p. 264).

PLATE 30 Fig. 99

MAP 99

100 GREAT SHEARWATER

other: Greater Shearwater
Puffinus gravis

Length 46–53cm (18–21in). Wingspan 100–111cm (39–44in). Iris brown. Bill black. Legs flesh, outer webs brown

Atlantic Ocean; range overlaps with Cory's Shearwater and Black-capped Petrel (p. 257, p. 259). Sexes alike; no seasonal variation, but during moult (Jul/Aug) most show white across upperwing-coverts. Juveniles as adults although somewhat grayer with paler feather edgings; photographs supplied by Kellow (pers. comm.).

Apr/May moving N into Pacific past Japan to winter N of subtropical convergence. Some move E to western North America, where a few recorded annually Jul–Dec from British Columbia S to California. Status off Baja California requires clarification; past records may refer to Parkinson's Petrel (see Jahn 1974). In Indian Ocean breeds St Paul I. and islands off southern coast of Western Australia from Cape Leeuwin to Recherche Archipelago; breeding and departure as for Pacific breeders but moves W across Indian Ocean to Mascarenes and Seychelles to winter in Arabian Sea, some occur S to Agulhas Current off South Africa, more rarely to Benguela Current. Some non-breeders of both groups remain in wintering quarters throughout year.

SS: Larger than Short-tailed and Sooty Shearwaters (p. 261, p. 260) with darker underwing and winged dark phase. Wedge-tailed Shearwater (p. 259) by bill and underwing colour and by wings held straighter, not bowed and well forward. White-climbed Petrel (p. 255) larger, heavier-billed, and feet project slightly beyond tail. See also juvenile Heermann's Gull (p. 331) if off California.

PLATE 29 Figs 100a–100b

MAP 100

showed some (juvenile?) off Bermuda with wholly brown hindnecks. No subspecies.

PLUMAGE: Head Cap brown (appears black at sea); remainder, including hindneck, mostly white. Body Upperparts: mantle, back, scapulars and short uppertail-coverts dark, greyish-brown faintly edged grey-buff; long uppertail-coverts white,

forming conspicuous horseshoe over tail. Underparts mostly white except for brownish sides of breast, blackish-brown belly patch and undertail-coverts. Wings Upperwing: primaries, their coverts, and secondaries blackish; remainder as uppertails. Underwing mostly white; coverts marked with brown, forming broken diagonal across coverts. Tail Blackish.

FMJ: A large, powerful species. Flight strong and purposeful with quick beats; wings held more stiffly than Cory's Shearwater (p. 257) and usually straighter, not bowed; in high winds rapid and bounding. Attends travellers, where noisy and aggressive sounding like lightning cats. Often plunges—dives from the air, 6–10m above surface; also pursues fish from surface.

DM: Breeds in southern Atlantic Ocean at Nightingale and inaccessible Is. Tristan da Cunha; and at Gough I. Numbers apparently increasing; some estimates of numbers on Nightingale I. having risen from 2 to 4 million. A pair found breeding at Kidney I., Falklands, may represent a hitherto unknown small colony (Woods 1975) or, equally, the beginning of a range expansion. Returns to colonies Sep onwards; egg-lates Nov; fledging and dispersal of juveniles begins May. Adults

101 WEDGE-TAILED SHEARWATER

Puffinus pacificus

Length 41–46cm (16–18in). Wingspan 97–106cm (38–42in).

Tropical Pacific and Indian Oceans; range overlaps with Flesh-footed and Pink-footed Shearwaters (p. 258, p. 257). Sexes alike; no seasonal variation but upperwing-coverts sometimes wear paler. Juveniles and adults alike. No subspecies; polymorphic, occurs in two colour morphs with individual variation (be aware!).

DARK MORPH: Wholly blackish-brown, primaries and tail darker.

PALE MORPH: Head Crown, nape and sides of face brown, chin and throat white. Body Upperparts paler brown than in dark morph. Underparts mostly white, sides of breast, flanks and undertail-coverts molted with brown. Wings Upperwing as dark morph. Underwings mostly white; axillaries and margins brown. Tail Brown.

FMJ: Fairly large shearwater; experienced observers will notice bowed wings held slightly above body and well forward to impart characteristic jizz. Wings broad, particularly secondaries; primaries short, rounded at tip. Tail shape not reliable character though imparting more slender appearance to body. Flight in \pm FS or below drifting, unhurried, with slow flaps followed by short upward glide before banking down to water; often circles at low speed; in higher winds swifter, bounding; wings remaining bowed and well forward.

DM: Tropical Pacific and Indian Oceans, breeding in former from Pescadores (near Taiwan) and Bonin and Volcano Is throughout most of tropical and subtropical Pacific from Barrier Reef islands of Australia E to Revilla Gigedo Is off Mexico and SW to Pitcairn group. In Indian Ocean sector breeds off Madagascar, Seychelles, Amirante, Mascarene, Caragados Carajos Shoals, Chagos Archipelago,

begin trans-equatorial migration in Apr, moving NW to eastern littoral of South America, and then N passing Bermuda May–Jul (Pellow, pers. comm.) to reach Grand Banks area off Newfoundland Jul/Aug. Many penetrate N to about 60°N before moving eastwards past Greenland to NE Atlantic sector, where relatively abundant off SW Ireland Sep/Oct; casual off Scandinavia and in North Sea. Most have departed from North Atlantic by Nov, but there appears to be a non-breeder staging area in western North Atlantic during late autumn with flocks of up to 200,000 off Cape Cod, Massachusetts (Powers and van Os 1979). Only Pacific record is of single bird in Monterey Bay, California, Feb 1979 (see Robertson 1980). Has been recorded off Strait of Magellan.

SS: Separated from Cory's Shearwater (p. 257) by distinctly capped appearance, white nape, band over tail and different underwing pattern; dark belly patch difficult to observe at sea but, if seen, diagnostic. Off eastern North America Black-capped Petrel (p. 259) has broad white rump patch, different underwing pattern and fast, swooping flight. Beware distant views of Northern Fulmar (p. 235); see notes under that species.

PLATE 30 Figs 101a–101b

MAP 101

Iris brown. Bill dark grey. Legs/feet flesh-white.

Cocos (Keeling) Is and on islands off Western Australia. Egg-lates vary with locality. Tropical populations probably non-migratory. Some subtropical populations range widely throughout tropical parts of Indian and Pacific Oceans. Distribution probably linked with preference for warm water. Now recorded annually off South Africa (Sinclair, pers. comm.).

SS: Differs from Flesh-footed Shearwater (p. 258) in bill colour, darker underwing shafts, broad bases to wings and characteristic buoyant, drifting flight with wings held bowed and well forward. From Jouanin's Petrel (p. 254) by flight, jizz and much larger size, longer grey bill and pale legs. Pale phase differs from Bulwer's Shearwater (p. 260) by lack of cap, uniform upperparts and underwing markings. Range overlaps with larger, broader-winged Pink-footed Shearwater (p. 257) off W Mexico.

Fig. 8. P. carneipes has whitish bases to underside of primaries, and in flight wings normally held straighter. By comparison *P. pacificus* has wholly dark underwing and holds wings bowed and well forward (see also colour of *P. carneipes* diagnostic).



102 BULLER'S SHEARWATER

Puffinus bulleri

PLATE 28 Fig. 102

MAP 102

Length 46cm (18in.), wingspan 97cm (38in.). Iris brown. Bill blue-black, darker at tip. Legs/feet pinkish-black at extremities.

Breeds New Zealand sector, migrating E across Pacific to the Americas. Range overlaps with Pink-footed and Wedge-tailed Shearwaters (p. 257, p. 259). Sexes alike; no seasonal variation. Juveniles and adults alike. No subspecies.

PLUMAGE: Head Blackish-brown cap; remainder white. Body Upperparts mostly brownish-grey, edged buff-grey, imparting frosted appearance shading to blackish-brown across rump. Underparts white. Wings Upperwing greyish-brown with conspicuously pale greater coverts, and striking blackish W pattern linked across rump (an excellent character found in no other shearwater). Underwing white with narrow blackish margins. Tail Blackish.

FHJ: Large, slender-bodied shearwater with strikingly patterned underparts and graceful, measured flight. Jizz recalls Wedge-tailed Shearwater. In low winds flight recalls that of smaller albatrosses, with slow, measured wingbeats and long glides close to surface; in higher winds arcs in graceful, effortless progression with little flapping (a stunning species). Feeds by briefly alighting to pick off the surface or submerge head. Gregarious, often forms small flocks at sea.

103 SOOTY SHEARWATER

Puffinus griseus

PLATE 30 Fig. 103

MAP 103

Length 40-46cm (16-18in.), wingspan 94-104cm (37-41in.). Iris brown. Bill dark grey. Legs/feet blackish-grey.

Wide-ranging in Pacific and Atlantic Oceans; range overlaps with Short-tailed Shearwater and Great-winged Petrel (p. 261, p. 237). See also Kermadec Petrel (p. 242) and, in North Atlantic, Balearic Shearwater (p. 263). Sexes alike; no seasonal variation. Juveniles and adults alike. Partial albinism occasionally reported; beware especially symmetrically partial albinistic Sooty Shearwaters, which can suggest Cape Petrel (p. 236) (Stalcup 1976).

PLUMAGE: Head and Body Mostly sooty-brown; chin and throat greyer, underparts slightly paler. Wings Upperwing mostly sooty-brown, primaries and secondaries darker. Underwing brownish-black with silvery coverts, variable in extent, normally showing as white wing-flash; atypical shows mostly grey underwing (see Short-tailed Shearwater, p. 261). Tail Blackish-brown.

FHJ: Wings long, narrow, with back-swept posture and rather heavy body imparting characteristic jizz. Flight normally strong and direct, two to eight quick, stiff-winged flaps on ascending tack followed by long glide; in higher winds fast and careening. A gregarious species often seen in huge, loose flocks during migration in Pacific, less so in Atlantic. Plunges headfirst from about 1m with wings open, submerging for short periods. Does not normally follow ships; attends trawlers. DM: Trans-equatorial migrant in Pacific and Atlantic Oceans. Breeds off South America at Staten, Wol-

DM: Trans-equatorial migrant breeding at Poor Knights Is., New Zealand, where population has undergone massive expansion in recent years. Returns to colonies Aug/Sep; egg-laying Nov/Dec. fledging and dispersal begins Apr. birds moving to Tasman Sea and then E across Pacific. Little known of movements and routes but it occurs from Valparaiso, Chile, to American Pacific coast, where regular off California from late Jun through Nov. Range extends N to Oregon, Washington and British Columbia; occasionally Alaska. Numbers vary year to year, apparently governed by water temperature and salinity; peak count off Oregon up to about 1,000 per day. Small numbers remain in NE Pacific throughout northern winter. Not recorded in Australia until 1954; since then several found in burrows on islands off New South Wales but breeding not yet proved (see Severn et al. 1971). Some remain S during austral winter (Fullagar and van Tels, pers. comm.).

SS: Boldly patterned upper surfaces contrasting with white underparts separate this species from all other Pacific shearwaters. Beware *Pterodroma externa* group (p. 246).

laston and Decell's near Cape Horn, perhaps also on islands off southern Chile. In Australasian region small numbers breed on islands off New South Wales and SE Tasmania. Principal colonies situated off New Zealand at Snarres, Auckland, Campbell, Chatham, Antipodes and Stewart's, and islets in Foveaux Strait; smaller numbers at Macquarie I. Returns to colonies Sep-Nov; egg-laying Nov/Dec; fledging and departure Mar-May. Most South American breeders depart N into Pacific reaching Monterey Bay, California, where commonest shearwater Jul-Nov when flocks of several million often seen from shore. Many continue N to Alaska. Return migration begins Aug; peak numbers off Ecuador and Peru Oct/Nov. Proportionately fewer migrate northwards along eastern South America to reach Atlantic coasts of USA and Canada in Jun. Disperses eastwards across N Atlantic Jul; present European waters Aug-Nov, with peak daily figures off NW Spain (Estacia de Barres) around 3,000 (Huyssens & Maes 1971). Small numbers recently recorded E Mediterranean Aug-Dec (H. Shirah, pers. comm.). Australasian breeders move rapidly N and E past Japan to reach Alaska Jul/Aug. Non-breeders occasionally remain N of Equator in both oceans. Common inshore migrant off western South Africa but origins unclear; most likely from South America but may also be non-breeders observed moving W along Australian Antarctic coast in late summer

104 SHORT-TAILED SHEARWATER

Puffinus tenuirostris

PLATE 30 Fig. 104

MAP 104

Length 41-43cm (16-17in.), wingspan 97-100cm (38-39in.). Iris brown. Bill, legs/feet blackish-grey.

Breeds off southern Australia, migrating N to Alaska and western coasts of North America. Range overlaps with Sooty Shearwater and Great-winged Petrel (p. 260, p. 237). Sexes alike; no seasonal variation but plumage may wear rather grey with faint capped appearance on crown. No subspecies. Partial albinism recorded.

PLUMAGE: Head and Body Mostly sooty-brown, underparts slightly paler. Wings Upperwing: sooty-brown, primaries and secondaries darker. Underwing normally brownish-black with dull grey coverts but variable, some with whiter coverts (beware Sooty Shearwater, p. 260). Tail Blackish-brown. FHJ: Gregarious, resembling Sooty Shearwater in habits and jizz. At close range bill shorter than that of species. Sometimes follows boats.

DM: Pacific trans-equatorial migrant; breeds in huge numbers Bass Strait, and off Tasmania, New South Wales, Victoria, and S Australia; perhaps also in W Australia in Recherche Archipelago (Fullagar & van Tels, pers. comm.). Returns to colonies late Sep; egg-laying Nov/Dec; fledging and departure Apr/May, moving rapidly NE into Pacific and Japan to reach main wintering area off Aleutian Is. mid May/Jun. Some move N to Bering and Chukchi Seas; common Bering Strait Jul, occurring off Barrow till late Sep. Small numbers

broader wings, darker underwing. See also Flash-footed and dark phase Wedge-tailed Shearwaters (p. 258, p. 259). In North Atlantic dark race of Manx Shearwater *P. puffinus mauretanicus* (p. 263) as large, sometimes as dark, as *P. griseus* but underparts show some white with dark underail-coverts; wings appear shorter, less swept back. See also notes under skuas/jaguers (p. 323).

move E to western coasts of North America, where uncommon from Washington S to California, most occurring Nov-Feb (Stalcup 1976). A few non-breeders remain in Alaskan waters throughout winter to 30°N. Rapid return movement mainly through central Pacific, beginning Sep and compelling vast figure-of-8 movement to reach Australian coast Oct/Nov, where peak counts 60,000 per hour off New South Wales (Carter & Barton, in Fullagar 1978). Stragglers have reached India, Macquarie I., and west coast of New Zealand. Status off W Thailand, where known from two birds captured live at sea off Phuket I., requires clarification; fishermen report that this (or dark shearwater of some species) occurs off W Thailand in reasonable numbers (P. Round, pers. comm.; see also Frith 1978).

SS: Difficult to separate from Sooty Shearwater (p. 260) at any range. Main diagnostic feature is shorter bill and, usually, greyer underwing-coverts (Fullagar & van Tels, pers. comm.). In winter quarters Short-tailed appear darker, more evenly coloured than Sooty, some with indistinct caps and whitish chins. See also Wedge-tailed, Flash-footed Shearwaters and Great-winged Petrel (p. 259, p. 258, p. 237).

105 HEINROTH'S SHEARWATER

Puffinus (heinirothi) heinirothi

PLATE 31 Fig. 105

MAP 105

Length 27cm (10in.), wingspan not recorded. Iris brown. Bill blackish. Legs/feet flesh-pink.

Known only from seas off Rabaul, New Britain, tropical western Pacific Ocean; range probably overlaps with migrating Short-tailed Shearwaters (p. 261). Sexes probably alike; no seasonal variation but marked individual variation in amount of white on underparts. Juveniles and adults alike. A little-known species; the following descriptions are based on notes supplied by Dr G. Maersberger (pers. comm.) after examination of six skins in the Berlin Museum (including the type specimen). No subspecies but considered conspecific with Audubon's Shearwater by some authors.

PLUMAGE: Head Sooty-brown, chin and throat sometimes greyer. Body Upperparts sooty-brown. Underparts variable; either wholly sooty-brown (a little paler than upperparts), or with small white tips across lower breast forming distinct patch, which, in one specimen, extended to lower belly.

Underail-coverts in all types sooty-brown. Wings Upperwing sooty-brown. Underwing white with variable dark margins and tip.

FHJ: Unknown. DM: Known only from seas near Rabaul, New Britain. Breeding islands as yet undiscovered but Dr Mayr (pers. comm.) reports that one recently flew into a light in a mountain village on Bougainville, Solomon Islands, and there seems little doubt that it breeds there. Breeding dates and pelagic distribution unknown. **SS:** Combination of small size, white on underwing and (if present) on belly should impart appearance distinct from transient Short-tailed Shearwater (p. 261).

Key To Identification of Designated Bird Species in Squid Fishery Area
Patrick J. Gould, June 1, 1989.

SPECIES*	BACK	BELLY	BILL	FEET	SPECIAL MARKS
DA (A)	white	white	pink	pale	very large bill.
DA (I)	dark	white	pink	pale	very large bill, white patch on upper wing.
DN	dark	dark	dark	dark	may have white around bill and on rump.
DI	dark	white	grey	pale	bill may tend to yellowish.
FG (D)	dark	dark	yellow	varies	bill short/thick stubby, whitish triangle in outer wing. Appears bull-headed.
FG (L)	gray	white	yellow	varies	bill short/thick stubby, whitish triangle in outer wing. Appears bull-headed.
PS	dark	dark	pale	pale	large bill.
PG	dark	dark	dark	dark	irregular white patches in underwing. Bill and body somewhat larger & heavier than ST.
ST	dark	dark	dark	dark	underwing uniform silvery, may look white in reflected light.
PB	gray	white	dark	pale	dark cap, dark "M" on top of wings. Bill slender.
LC (A)	dark	dark	red	orange	bill large, triangular.
LC (I)	dark	grey	dark	pale	bill small, almost stubby.
FPC (A)	dark	white	yellow	orange	bill large, triangular, tipped with red.
FPC (I)	dark	white	dark	pale	bill small, almost stubby.
OL	dark	dark	dark	dark	white rump patch.

*: Species arranged from largest to smallest: DA (Short-tailed Albatross); DN (Black-footed Albatross); DI (Laysan Albatross); FG (Northern Fulmar); PS (Flesh-footed Shearwater); PG (Sooty Shearwater); ST (Short-tailed Shearwater); PB (Buller's Shearwater); LC (Tufted Puffin); FC (Horned Puffin); OL (Leach's Storm-petrel).
A = adult; I = immature; D = dark phase; L = light phase.

KEY TO GREBES (Cont.)

- 6' Width and height of bill at base similar, tip may be slightly upturned; tarsus 38-44.5 mm. In winter, dark of cap extending below eye; in breeding plumage, neck and upper breast black, some chestnut on flanks. EARED GREBE

KEY TO ALBATROSSES

- 1 Body, head and neck white or mottled white and dark brown. 2
- 1' Entirely dark brown. 3
- 2 Area of back between wings white or mottled white and dark brown; culmen 120-145 mm; bill depth measured at anterior edge of nares, 34-35 mm; tarsus 91-101 mm; wing length 518-555 mm. SHORT-TAILED ALBATROSS, adult
- 2' Area of back between wings entirely dark; culmen 99-114 mm; bill depth 24-34 mm; tarsus 78-86 mm; wing 470-510 mm. LAYSAN ALBATROSS, adult and immature
- 3 Bill and feet light tan or yellow; measurements as in 2 SHORT-TAILED ALBATROSS, immature
- 3' Bill and feet black or dark brown; culmen 94-113 mm; bill depth 29-40 mm; tarsus 80-95 mm; wing 485-533 mm. 4
- 4 Considerable white on face. BLACK-FOOTED ALBATROSS, adult
- 4' No (or only a very small amount of) white on face. BLACK-FOOTED ALBATROSS, immature sub adult, or young adult

KEY TO PETRELS

- 1 Bill length <18 mm; wing length <180 mm; tarsus <30 mm OR if 33-37 mm then feet with yellow on webs; tarsus decidedly longer than middle toe with claw (STORM PETREL). 2
- 1' Bill >25 mm; wing >200 mm; tarsus >38 mm OR if 33-37 mm then feet are entirely black; tarsus not longer than middle toe with claw. 10
- 2 Body, head and neck light to medium bluish-gray; wings with blackish flight feathers but with gray coverts. FORK TAILED STORM-PETREL
- 2' Body, head and neck blackish-gray to sooty brown, except for rump which may or may not be white and secondary upper wing coverts which may or may not be distinctly buffy. 3
- 3 Wing length >165 mm; tarsus 29-33 mm but if close to 33 mm then feet entirely black and no white on rump. BLACK STORM PETREL
- 3' Wings <162 mm; tarsus 25-33 mm but if close to 33 mm then webs of feet with light (yellow) spots and with white feathers in rump, flanks and under tail coverts. 4
- 4 At least some white on some rump feathers (upper tail coverts). 5
- 4' No white on any feathers of rump or flanks. 8
- 5 Tarsus >30 mm; light (yellow) area on webs of feet; some and usually many under tail coverts white. WILSON'S STORM PETREL
- 5' Tarsus <26 mm; feet entirely black; under tail coverts not white. 6
- 6 Upper tail coverts white to the tips including central two (feather shafts dark); tail short, longest tail feather (from skin to tip) 56-57 mm; longest (central) white rump feathers extend about 2/3 the length of the tail (Fig. 19 b); culmen often <12.9 mm (10.6-14.0 mm). GALAPAGOS STORM PETREL
- 6' Rump extensively white with most of the longer upper tail coverts in center of rump having dark tips except perhaps the most central ones which may sometimes be entirely white or entirely dark OR only a few feathers on either side of rump have some white (sometimes confined to one white spot on one feather on either side); longest rump feathers extend only about 1/2 the tail length (Fig. 19 a). 7

TO PETRELS (Cont.)

- 7 Two central-most upper tail coverts within the largely white rump patch completely dark or partly dark OR only a few feathers on either side of rump with at least some white; shafts of white rump feathers dark; bases of outermost tail feathers usually dark, but if white, then only for about 1 cm.

LEACH'S STORM PETREL, light phase

- 7' The several longest upper tail coverts in center of rump white but with dark tips; shafts of white rump feathers white; lateral tail feathers white at base for 2.5 cm or more.

HARCOURT'S STORM PETREL

- 8 Coloration blackish-gray all over (not brown), particularly on ventral surfaces of wings; upper wing coverts not distinctly buffy (only slightly, if at all).

9

- 8' Coloration brown, particularly under wing coverts; upper wing coverts very decidedly buffy forming a bar running diagonally from the body to the wrist (not including scapulars); north of Pt. Conception almost all with wings >144 mm (very rarely to 142 mm long).

LEACH'S STORM PETREL, dark phase

- 9 Wing length <130 mm; bill length <12 mm; central tail feathers longer than or as long as outer ones (i.e., tail wedge-shaped or square, not forked); upper tail coverts (rump feathers) extend about 2/3 the length of tail feathers (Fig. 19b).

LEAST STORM PETREL

- 9' Wing 131-142 mm (very rarely to 145 mm); bill 13-15 mm; tail forked; upper tail coverts extend only about 1/2 the length of tail feathers (Fig. 19a).

ASHY STORM PETREL

- 10 Back, mantle of wings, and rump boldly checkered black and white; broad black band at tip of white tail.

CAPE PETREL

- 10' Coloration not as above.

11

- 11 Underwings white with a broad black bar running from wrist to "armpit"; breast white but belly charcoal gray; bill black, <29 mm long and heavy in proportion (not slender; Plate 5); tarsus <38 mm.

SCALED (MOTTLED) PETREL

- 11' If underwings white then without the broad black bar referred to above; if breast white then belly white also; bill brown, yellow, horn color or pale, >29 mm but if 29-30 mm then especially slender; tarsus >42 mm.

12

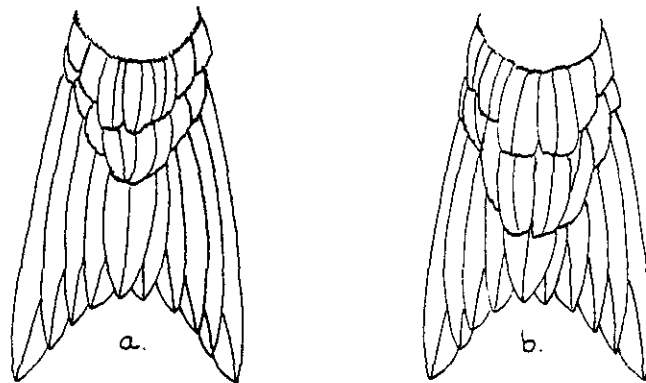
KEY TO PETRELS (Cont.)

- 12 Bill large and thick, nasal tube prominent, about 40% of bill length (Plate 5); lower mandible not decidedly hooked at tip; body stocky; tarsus rounded in cross-section. 13
- 12' Bill slender (especially when viewed from above), nasal tube about 25% of bill length (Plate 6); lower mandible hooked; body slender, torpedo-shaped; tarsus flattened laterally when viewed in cross-section. 15
- 13 Underparts of body white. 14
- 13' Underparts of body light gray to dark brown. NORTHERN FULMAR, dark phase
- 14 Crown, nape and hind neck light gray; underside of head and neck white. NORTHERN FULMAR, intermediate phase
- 14' Head and neck white. NORTHERN FULMAR, light phase
- 15 Belly white or partly white. 16
- 15' Bird entirely dark, except bill and feet may not be dark. 19
- 16 Wing length 270-300 mm; tail decidedly wedge-shaped; under tail coverts white; inner webs of primaries largely white; in fresh plumage, back light to medium gray; a prominent dark "W" pattern visible when both wings are extended (not evident in worn plumage). BULLER'S SHEARWATER
- 16' Wing <270 mm OR greater than 300 mm; tail not decidedly wedge-shaped; under tail coverts dark; inner webs of primaries dark; back brown, never a "W" pattern over wings and mantle. 17
- 17 Wing <270 mm; bill black along top and at tip, remainder bluish-gray; legs and feet light (flesh-colored) but with outer side of tarsus and outer toe black. COMMON SHEARWATER (See Species Accounts)
- 17' Wing >300 mm; bill largely straw-colored except darker along top and at tip; legs and feet entirely light (flesh-colored) but tending toward brown along outer toe. 18

12: TO PETRELS (Cont.)

- 18 Under tail coverts white; feathers of forehead, face and sides of neck white each with a central dark streak running along the shaft giving a streaked appearance to these areas; coloration of bill warm tan. STREAKED SHEARWATER
- 18' Under tail coverts dark; feathers of forehead, face and sides of neck usually dark but sometimes whitish and broadly tipped with dark coloration imparting a speckled appearance to these areas; straw-colored bill lighter than 18. PINK-FOOTED SHEARWATER
- 19 Bill straw-colored; feet and legs light-colored (pinkish in fresh specimens); wing length 298-333 mm. FLESH-FOOTED SHEARWATER
- 19' Bill and feet dark (black to brownish or bluish); wing 263-320 mm. 20
- 20 Wing linings (under wing coverts) generally brown; small (wing 263-290 mm, culmen 29-35 mm). SHORT-TAILED SHEARWATER
- 20' Wing linings usually light gray, in some cases almost white; larger (wing 280-320 mm; culmen 38-48 mm). SOOTY SHEARWATER

Figure 19. The length of upper tail coverts (rump feathers) relative to the length of the tail: tail coverts (a) about 1/2 the tail length and (b) about 2/3 the tail length.



KEY TO ALCIDS

- 1 Large: exposed culmen >25 mm; wing length >162 mm; tarsus usually >30 mm. 2
- 1' Small: exposed culmen <25 mm; wing <160 mm; tarsus usually <30 mm. 16
- 2 Underwing linings mostly white. 3
- 2' Underwing linings mostly dark. 8
- 3 A great deal of white in wing coverts of upper surface of wing; secondaries dark; feet may be pink to intense red. 4
- 3' Upper surface of wing dark except that secondaries are broadly tipped with white; feet black or brown. (MURRE) 5
- 4 Scapulars and back feathers checkered with black and white; upper wing coverts mottled black and white. BLACK GUILLEMOT, immature
- 4' Scapulars and back black; upper wing coverts extensively white. BLACK GUILLEMOT, adult
- 5 Throat and entire head dark. 6
- 5' Throat and lower cheeks white. 7
- 6 Cutting edge of bill at base white or yellow (giving appearance of a light mustache); depth of bill at gonydeal angle >1/3 the exposed culmen. THICK-BILLED MURRE, breeding plumage
- 6' Bill entirely dark; depth of bill at gonydeal angle <1/3 the exposed culmen. COMMON MURRE, breeding plumage
- 7 White cheeks extending upward behind eye to cap, then posteriorly to back of head (where black cap extends down neck), a distinct dark line extending from eye back to intersect most of white on side of head (as in Fig. 25); bill as in 6'. COMMON MURRE, winter adult and first year
- 7' White of cheeks posterior to eye not extending above eye level, dark line back from eye region indistinct; bill as in 6. THICK-BILLED MURRE, winter adult and first year

KEY TO ALCIDS (Cont.)

- | | | |
|-----|---|-----------------------------|
| 8 | Leading edge of wing black or dark brown. | 9 |
| 8' | Thin white line running along leading edge of wing from shoulder to wrist. | 11 |
| 9 | Extensive white coloration on upper surface of wing. | 10 |
| 9' | Upper wing surface entirely dark gray. | 14 |
| 10 | Upper wing coverts extensively white except for a black bar running part way through them. | PIGEON GUILLEMOT, adult |
| 10' | Upper wing coverts mottled black and white. | PIGEON GUILLEMOT, immature |
| 11 | Belly dark. | 12 |
| 11' | Belly white. | 13 |
| 12 | Face, including forehead, usually white; upper mandible usually with 2-3 vertical grooves (Plate 32-1); except during fall, long tufts of white to yellowish feathers extending backward from above eyes. | TUFTED PUFFIN, adult |
| 12' | Face (except small area behind each eye) dark; upper mandible smooth (Plate 32-6). | TUFTED PUFFIN, immature |
| 13 | Breast dark; face same gray color as remainder of head and upper surfaces (except that white plumes are often present). | 14 |
| 13' | Breast and belly white; dark collar extending around throat; face white or very light gray; no plumes. | 15 |
| 14 | White plumes projecting backward from behind eye and from cheek. | RHINOCEROS AUKLET, adult |
| 14' | White plumes on face absent. | RHINOCEROS AUKLET, immature |
| 15 | Face white. | HORNED PUFFIN, adult |
| 15' | Face light gray. | HORNED PUFFIN, immature |

KEY TO ALCIDS (Cont.)

- 16 Underwing lining (not flight feathers) white except for feathers along leading edge (Fig. 26). 17
- 16' Underwing lining dark, mottled, or light gray. 21
- 17 Wing length <105 mm; tips of secondaries white. 18
- 17' Wing >105 mm; tips of secondaries dark. 19
- 18 Dark collar completely encircling upper breast, separating throat from belly (Fig. 12a). LEAST AUKLET, breeding plumage
- 18' Collar around breast incomplete (Fig. 12b). LEAST AUKLET, winter adult or immature
- 19 Bill yellow to ivory (upper edge dark); culmen 12-16 mm; throat almost always entirely or partly dark (Fig. 26); wing length 122-141 mm. 20
- 19' Bill entirely dark, culmen 15-22 mm; throat entirely white (Fig. 26); wing 111-128 mm. XANTUS' MURRELET
- 20 Throat dark all the way to breast; long, thin white feathers prevalent above and behind eyes (an eyebrow) and on shoulders. ANCIENT MURRELET, breeding plumage
- 20' Throat mostly white except near base of bill (Fig. 26); long white feathers above eyes and on shoulder very sparse. ANCIENT MURRELET, winter adult or immature
- 21 Underwing linings mottled, white and gray. 22
- 21' Underwing linings entirely dark. 24
- 22 Feathers of throat and around anus gray. CASSIN'S AUKLET
- 22' Feathers of throat and around anus white (under down is gray). 23
- 23 Tail and flight feathers absent or tiny (Fig. 25); length of middle toe >32 mm. THICK-BILLED or COMMON MURRE, juvenile

KEY TO ALCIDS (Cont.)

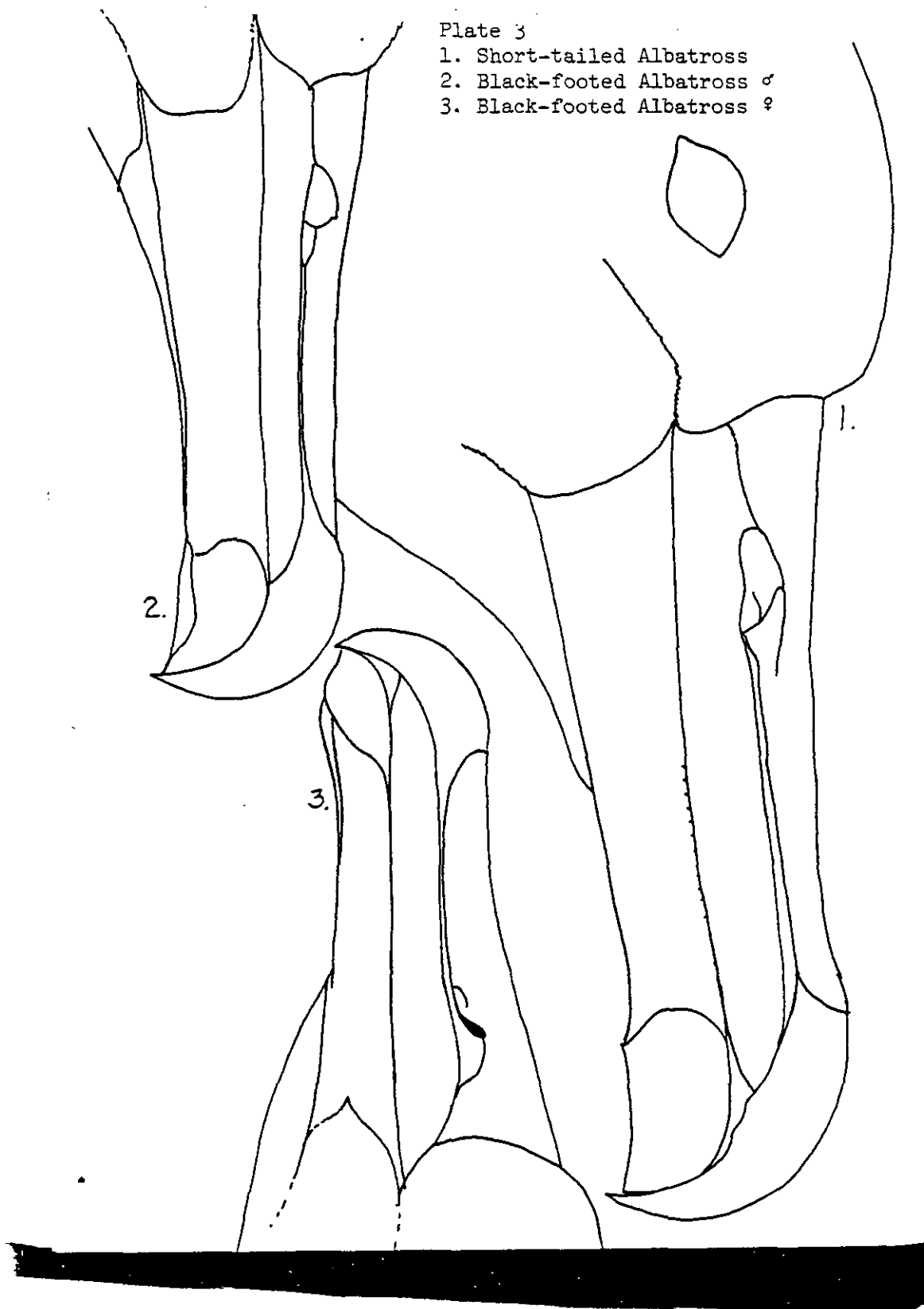
- 23' Tail and flight feathers present (as in Fig. 26); length of middle toe <26 mm. CRAVERI'S MURRELET
- 24 Wing length <90 mm; primaries absent or tiny (Fig. 25). THICK-BILLED OR COMMON MURRE, juvenile
- 24' Wing >95 mm; primaries present. 25
- 25 Wing length 97-105 mm. 26
- 25' Wing >115 mm. 27
- 26 Bill red with white tip; long curved feathers form crest on forehead; white facial plumes very prominent. WHISKERED AUKLET, adult
- 26' Bill yellowish at base, dark at tip; no crest; white facial plumes present but not prominent. WHISKERED AUKLET, immature
- 27 Secondaries and tail feathers broadly (2-3 mm wide) tipped with white. 28
- 27' Wing and tail feathers dark except some coverts on upper surface of wing may be very narrowly edged with white. 29
- 28 Belly and breast white except many feathers tipped with dark brown, giving undersurfaces a speckled appearance; remainder of head and body plumage brown, streaked with white and buffy. KITTLITZ'S MURRELET, breeding plumage
- 28' Sides of head and all undersurfaces completely white except for a dark incomplete breast collar (Fig. 12b) and a very occasional feather with a dark tip; scapular and shoulder feathers white. KITTLITZ'S MURRELET, winter or immature
- 29 Scapulars cinnamon OR white. 30
- 29' Scapulars gray, same color as remainder of wing. 31
- 30 Scapulars cinnamon; undersurfaces of body with white feathers tipped with brown giving spotted appearance; upper surfaces dark. MARBLED MURRELET, breeding plumage

KEY TO ALCIDS (Cont.)

- 30' Scapulars white; undersurfaces of body largely white except for occasional dark tipped feathers; lower face white.
MARBLED MURRELET, winter and immature
- 31 Bird entirely gray except often some elongated white feathers on face. 32
- 31' White on belly and breast; remainder of plumage gray except often some elongated white feathers on face. 33
- 32 No elongated, curved feathers on forehead forming a crest; no white plumes on face. CRESTED AUKLET, immature
- 32' Elongated feathers forming a crest on forehead; white plumes extending backward from face. CRESTED AUKLET, adult
- 33 Throat dark; bill red; elongated white plumes extending backward from behind eye. PARAKEET AUKLET, breeding plumage
- 33' Throat light; bill dark; no elongated white plumes on face. PARAKEET AUKLET, winter adult and immature

Plate 3

1. Short-tailed Albatross
2. Black-footed Albatross ♂
3. Black-footed Albatross ♀



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Plate 4

1. Frigatebird
2. Tropicbird
3. Laysan Albatross ♀
4. Laysan Albatross ♂

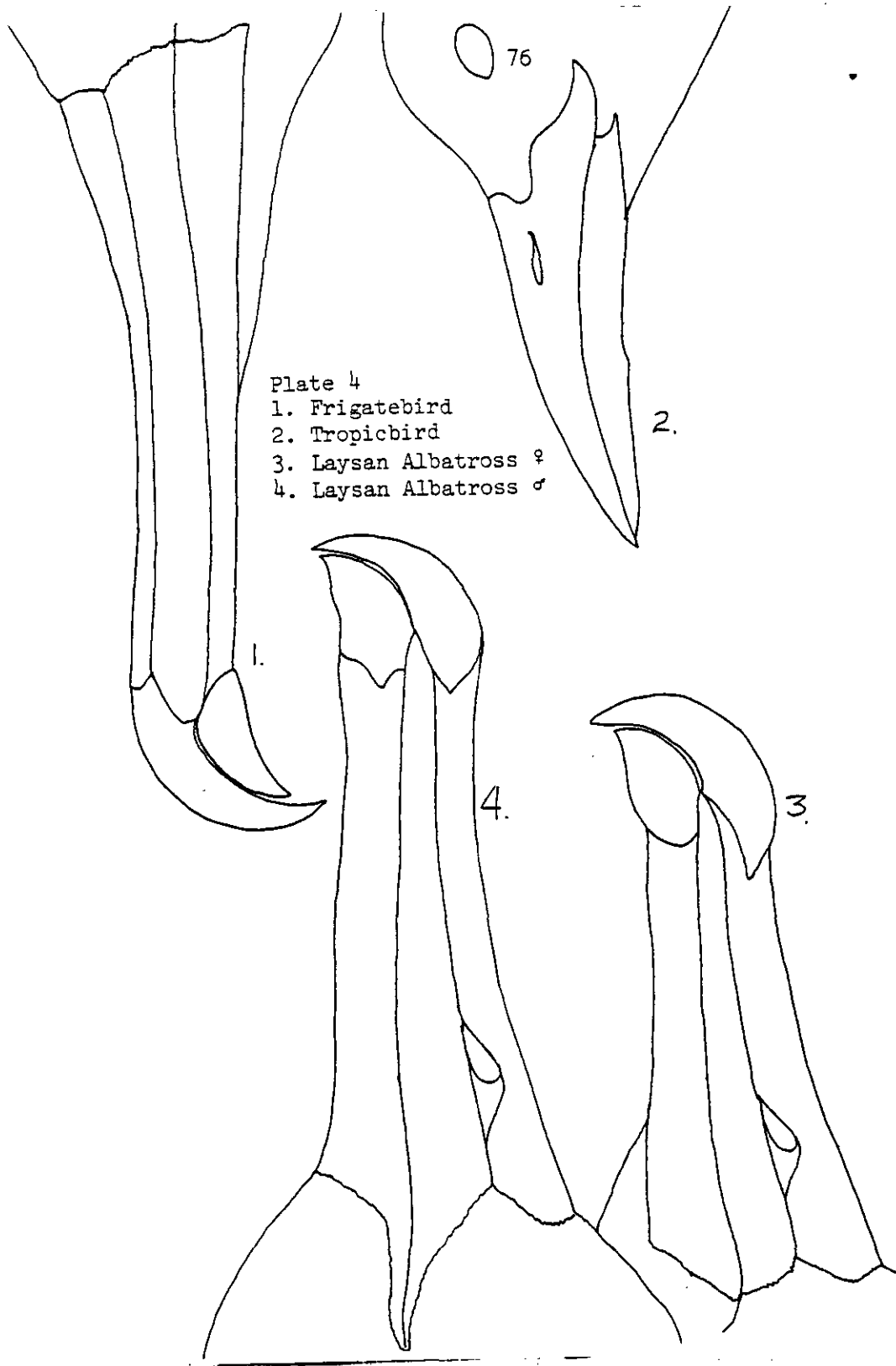
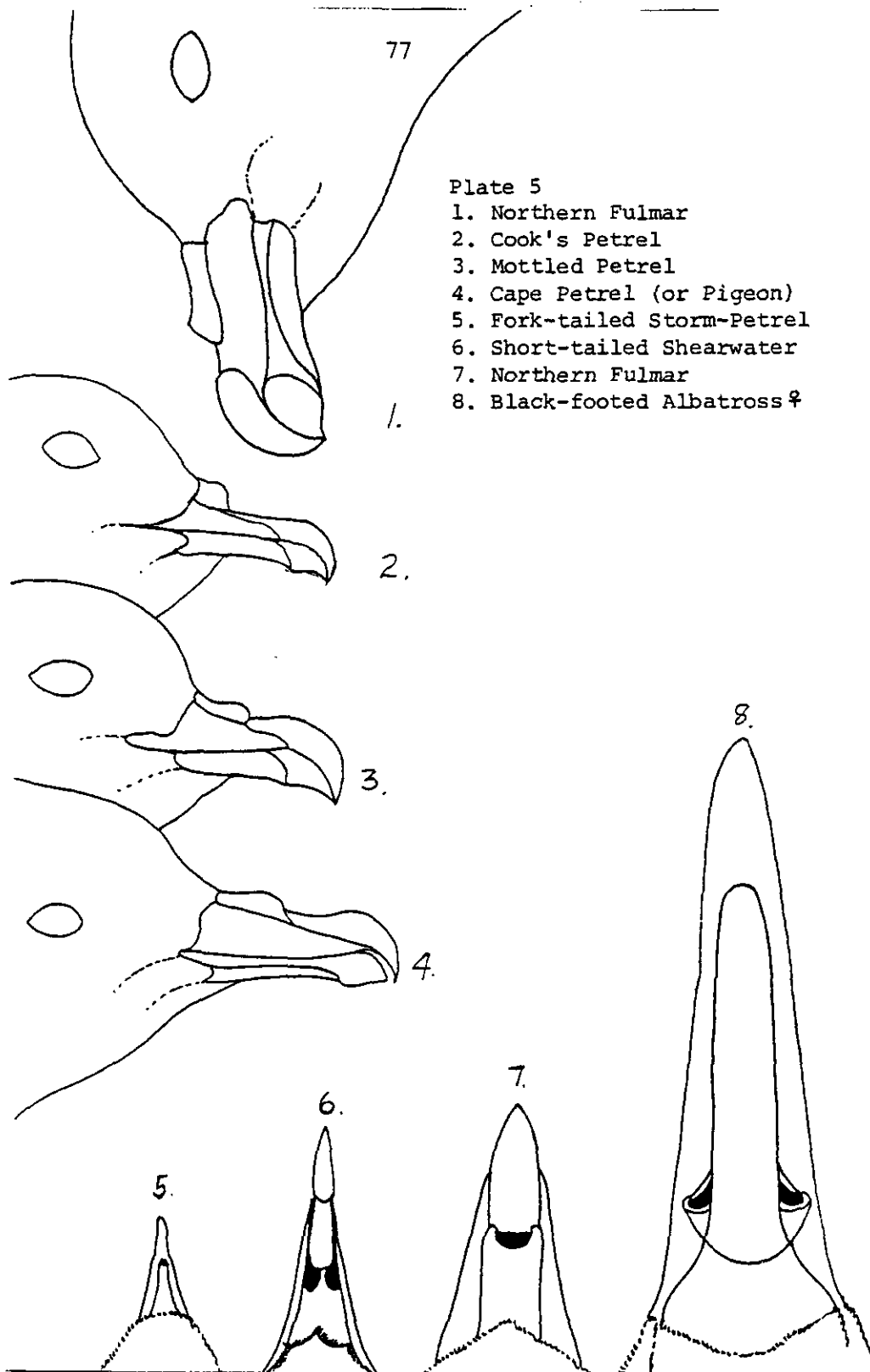


Plate 5

1. Northern Fulmar
2. Cook's Petrel
3. Mottled Petrel
4. Cape Petrel (or Pigeon)
5. Fork-tailed Storm-Petrel
6. Short-tailed Shearwater
7. Northern Fulmar
8. Black-footed Albatross ♀



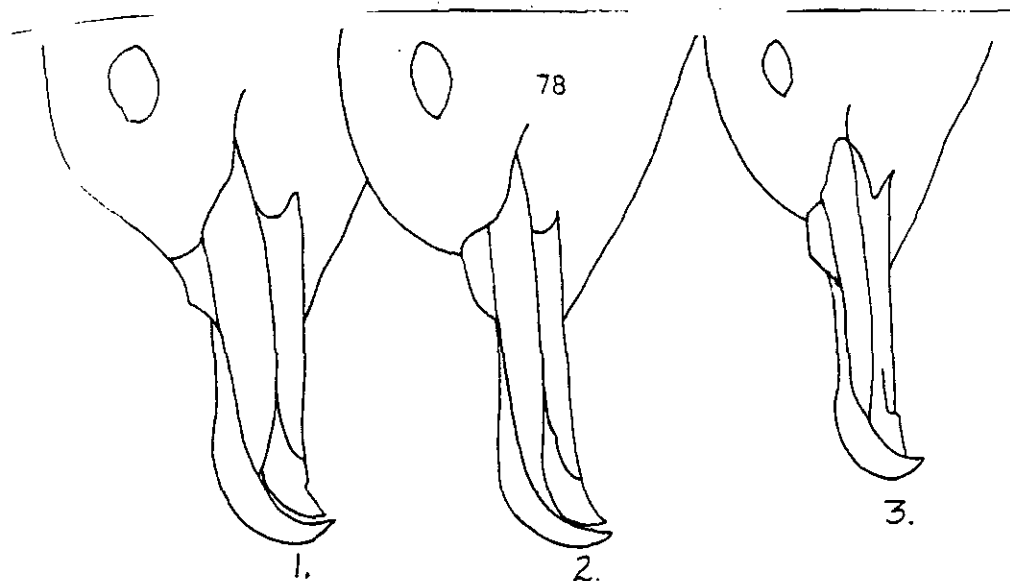


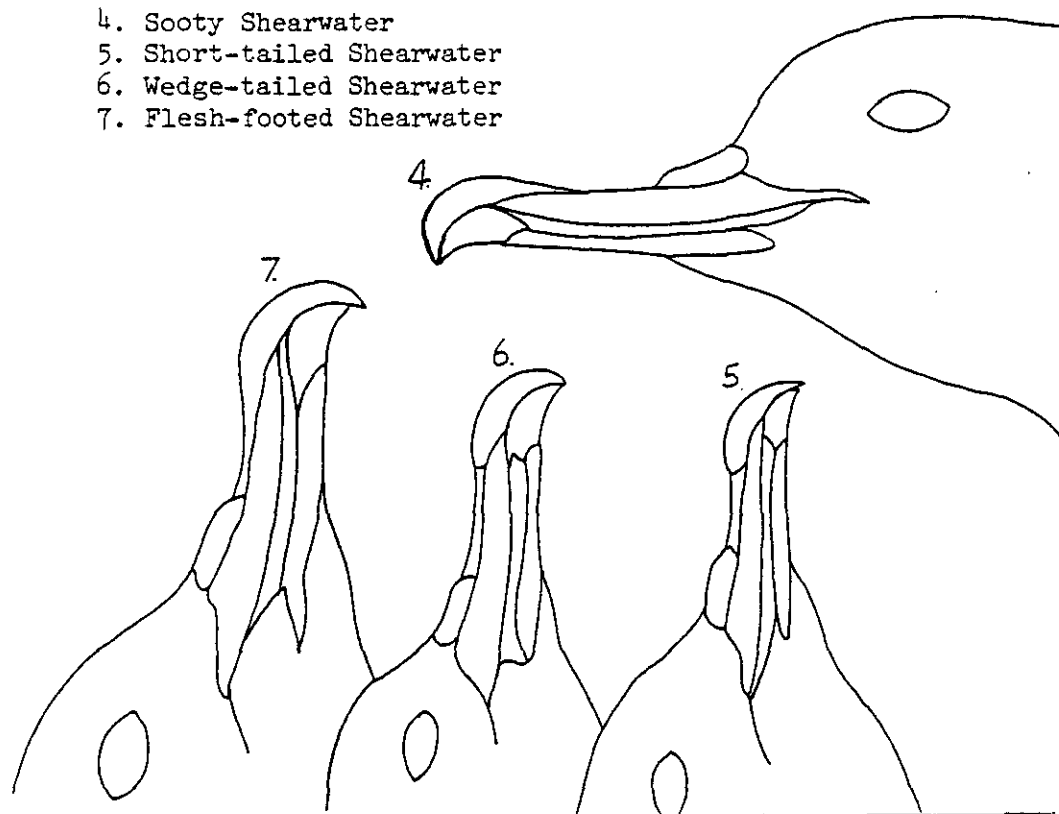
Plate 6

Light-bellied:

1. Pink-footed Shearwater
2. Buller's (New Zealand) Shearwater
3. Common (Manx) Shearwater

Dark-bellied:

4. Sooty Shearwater
5. Short-tailed Shearwater
6. Wedge-tailed Shearwater
7. Flesh-footed Shearwater



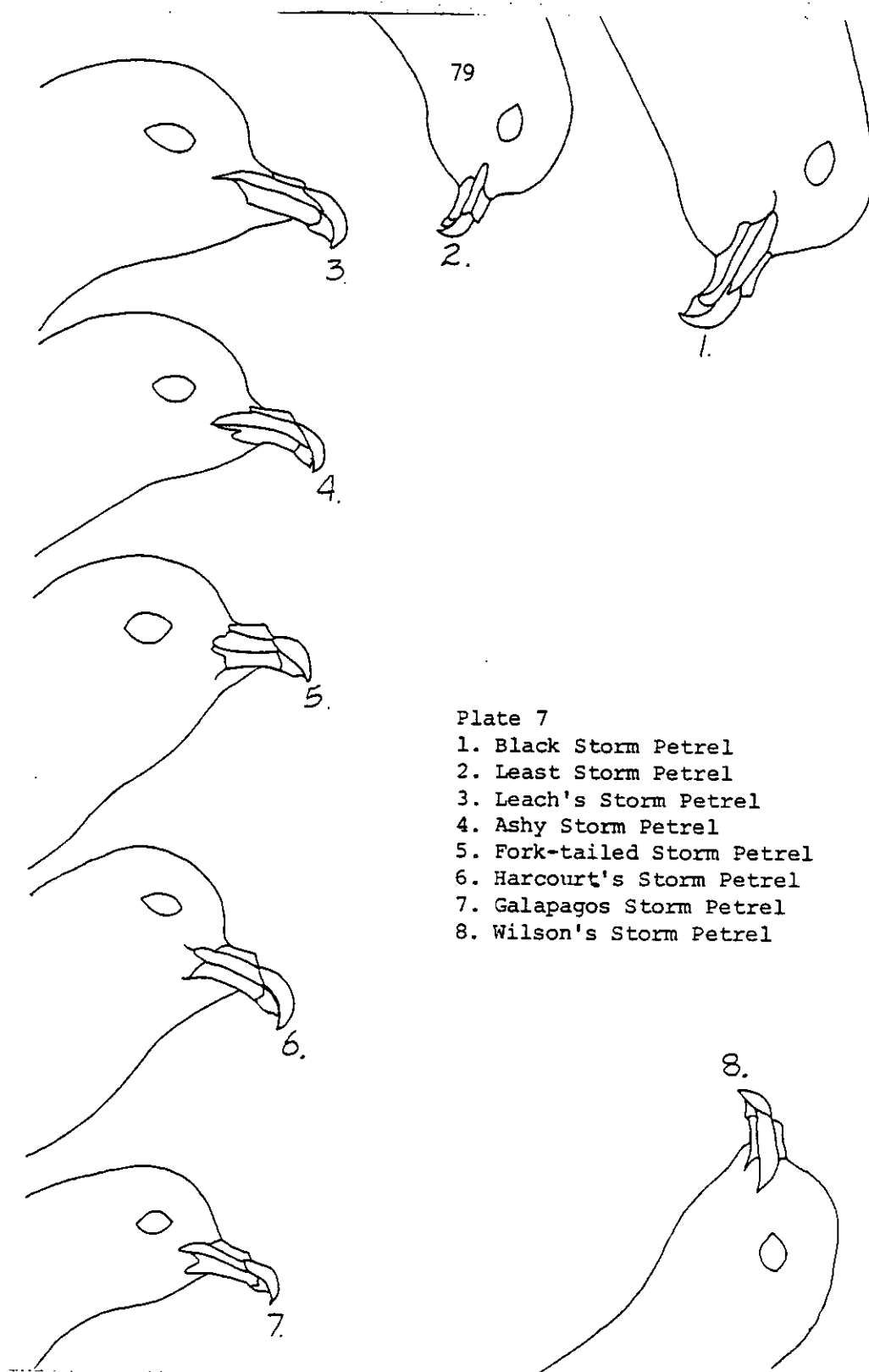
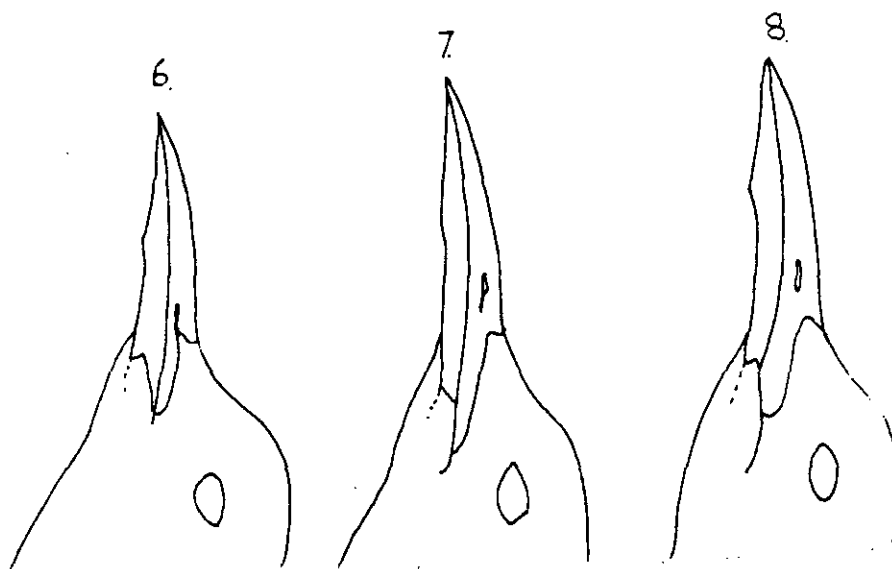
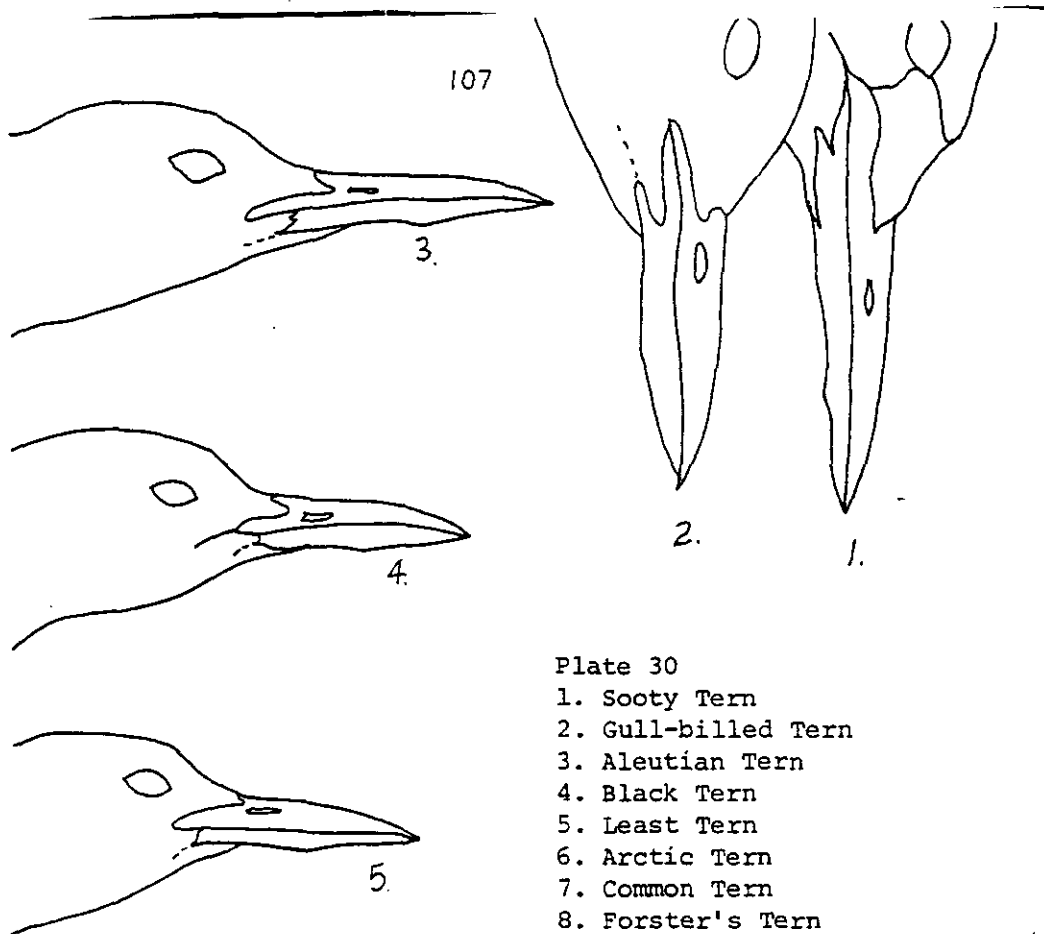
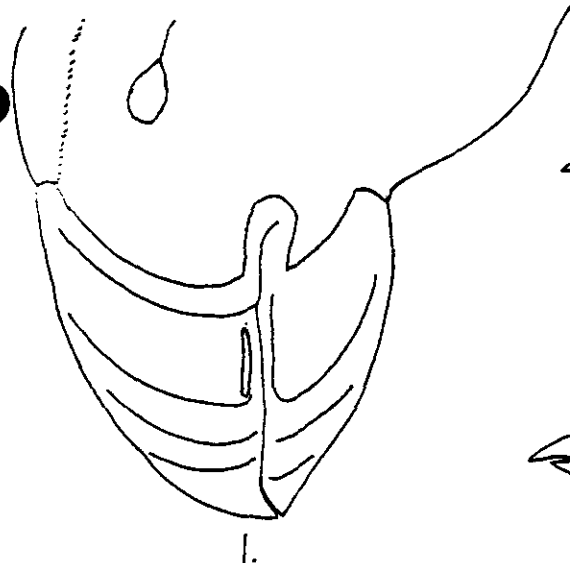


Plate 7

1. Black Storm Petrel
2. Least Storm Petrel
3. Leach's Storm Petrel
4. Ashy Storm Petrel
5. Fork-tailed Storm Petrel
6. Harcourt's Storm Petrel
7. Galapagos Storm Petrel
8. Wilson's Storm Petrel

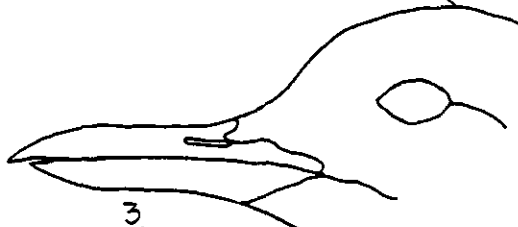




1.



2.



3.



4.

Plate 31

1. Horned Puffin, breeding adult

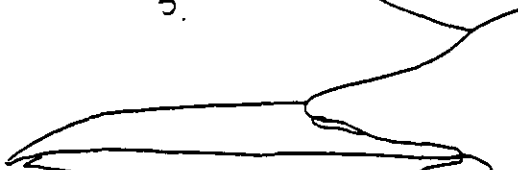
2. Black Guillemot

3. Pigeon Guillemot

4. Common Murre, hatching year

5. Common Murre (U. aalge californicus) adult6. Common Murre (U. aalge inornata) adult7. Thick-billed Murre (U. lomvia) adult8. Thick-billed Murre (U. lomvia) young

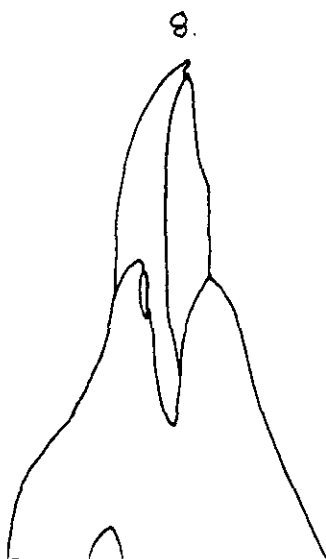
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6.



7.



8.

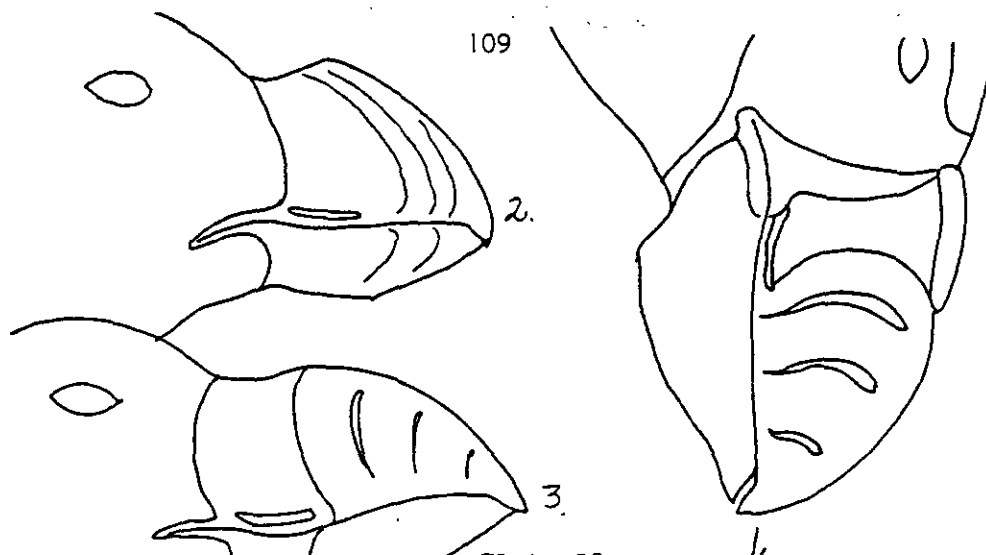
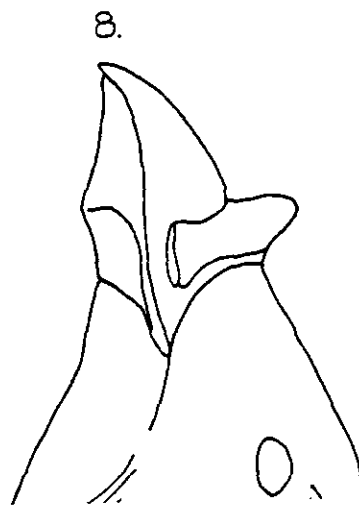
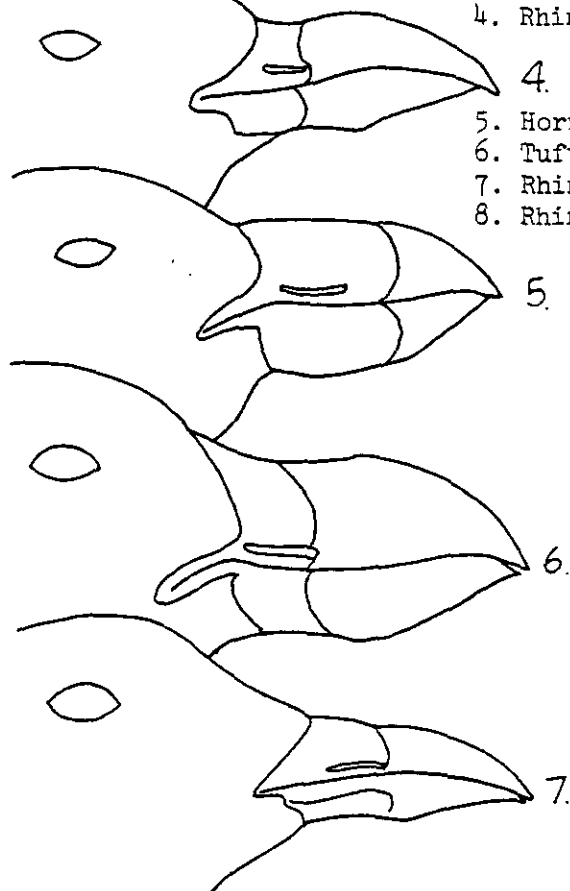


Plate 32

1. Tufted Puffin, breeding adult
2. Horned Puffin, winter adult
3. Tufted Puffin, winter adult
4. Rhinoceros Auklet, winter adult
5. Horned Puffin, young
6. Tufted Puffin, young
7. Rhinoceros Auklet, young
8. Rhinoceros Auklet, breeding adult



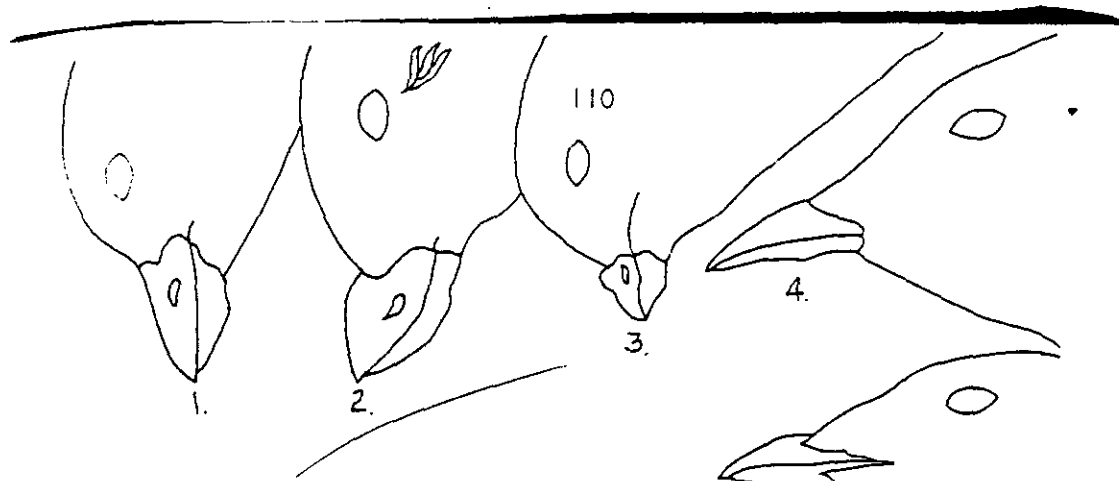
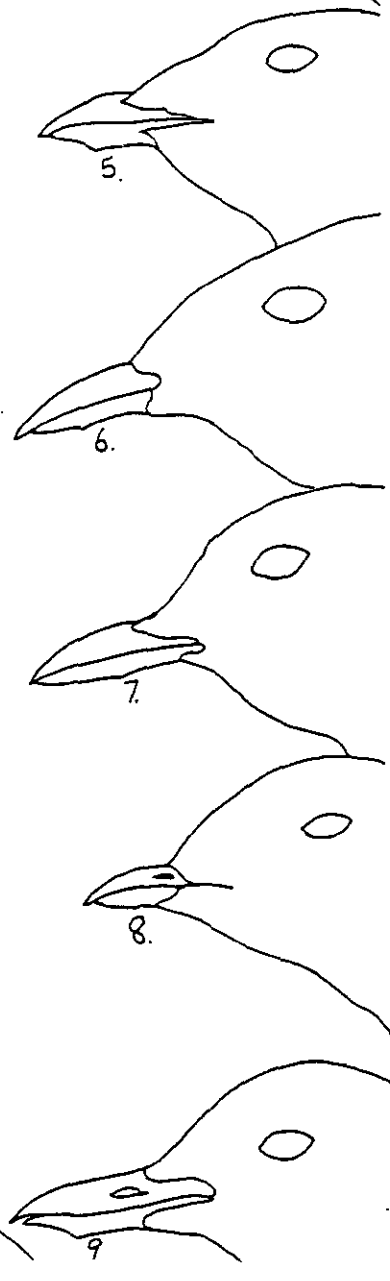


Plate 33

1. Cassin's Auklet
2. Parakeet Auklet
3. Whiskered Auklet
4. Marbled Murrelet
5. Ancient Murrelet
6. Xantus' Murrelet
7. Craveri's Murrelet
8. Kittlitz's Murrelet
9. Common Murre chick
10. Least Auklet
11. Crested Auklet



RED-NECKED GREBE (*Podiceps grisegena*; choice 2', pg. 25) occurs along most Bering Sea coasts only during summer, is found year round along coasts from the southern Bering Sea to southeast Alaska, and occurs south of there mainly during the fall, winter and early spring but rarely during summer. Individuals found south of central California are worthy of note.

HORNED GREBE (*Podiceps auritus*; choice 6, pg. 25) occurs along southern Bering Sea coasts during summer and from western Alaska to northern Baja California during fall, winter, spring and, rarely, during summer.

Tarsus measurements will separate most specimens from those of Eared Grebes. For headless specimens in winter plumage whose tarsi measure 43-45 mm, separation of the two species is virtually impossible.

EARED GREBE (*Podiceps nigricollis*; choice 6', pg. 26) is found in coastal waters only rarely during the summer, but otherwise year round from British Columbia to southern Baja California. See discussion of Horned Grebe for further clues on identification.

PIED-BILLED GREBE (*Podilymbus podiceps*; choice 5, pg. 25) is not abundant in marine waters, but specimens occasionally occur from British Columbia (perhaps rarely in southeast Alaska) to southern Baja California. They could occur in this region at any time of year. The characteristic shape of the toes, the more extensive webbing between the toes, the difference in white coloration of secondaries, and the tawny color (*vs.* white in the others) of the neck and breast should distinguish specimens of this species from other grebes of its size.

ALBATROSSES (DIOMEDEIDAE)

Enormous size in conjunction with very long, narrow wings are characters that should separate an albatross from any other kind of bird one could encounter. Other large birds such as pelicans, frigatebirds, swans and the largest geese all have rather broad wings. Using the keys properly, one should have no trouble in identifying the albatross specimens unless one finds a species not represented, a very unlikely but possible event. For this reason, the following accounts discuss only the occurrence of each species.

SHORT-TAILED ALBATROSS (*Diomedea albatrus*; choices 2 and 3, pg. 26). It would be truly remarkable to find a specimen now but since the population is recovering slowly from decimation, someday, once again, it could be the most abundant albatross along this coast. If a specimen is found, regardless of its stage of decomposition it should be taken to the nearest major museum. The species could occur at any time of the year in North American waters but perhaps more likely in summer. Its range in the eastern Pacific region used to extend from the Bering Sea to southern Baja California.

BLACK-FOOTED ALBATROSS (*Diomedea nigripes*; choices 4 and 4', pg. 26) occurs from the southern Bering Sea to southern Baja California, though not as abundantly south of the California Channel Islands. Specimens could be encountered at any time of year but mostly during summer.

LAYSAN ALBATROSS (*Diomedea immutabilis*; choice 2', pg. 26). A specimen found south of Oregon would be worthy of note but the event is very possible at least as far south as the California Channel Islands. Otherwise the species mainly occurs along the North American coast from the Aleutian Islands south to Oregon. It is most likely to be encountered during fall and spring.

FULMARINE PETRELS (PROCELLARIIDAE, subfamily FULMARINAE)

These birds are characterized by their rather stout, heavy bills that have an intricate series of separate sections (as shown in the PLATES). As a person, not too familiar with birds, described to us once in referring to a fulmar, he had found a "sea gull with its bill cracked in several places". The large, single tube enclosing the nostrils on the top of the bill (Plate 5) and the tarsi that are rather round in cross-section also distinguish fulmarine petrels from similarly sized and colored shearwaters. The cigar-shaped bodies (including tail) with long, slender wings separate fulmarine petrels and shearwaters from the similarly sized but plumper, more broad-winged and generally more strikingly colored ducks. All petrels, including shearwaters, storm-petrels, etc., possess such a distinctive odor that once one is familiar with it, one can smell it even on very old carcasses.

CAPE PETREL (*Daption capense*; choice 10, pg. 28). On very rare occasions (once every ten years or so) individuals of this species (a breeder on islands in south polar seas) are reported off the western North American coast. Its striking, black and white checkered plumage make it perhaps the most unmistakable bird discussed in this manual.

NORTHERN FULMAR (*Fulmarus glacialis*; choices 13'-14', pg. 29) is one of the most commonly encountered birds along the entire length of the western North American coast during the winter and early spring. Even during summer and fall, finding an occasional individual is to be expected. They probably occur in ice-free areas of the Bering Sea year round, but otherwise occur there mostly during late spring, summer and fall.

Any specimen possessing a head, because of the bill characteristics (see keys and Plate 5-1), cannot be mistaken for any other species (except maybe the Southern Hemisphere SILVER-GRAY FULMAR, which is not known to occur in this area). A headless specimen in dark-phase plumage could be confused with one of the dark shearwaters, and one in light-phase plumage could be confused with an adult gull. The latter, however, is not likely if one is aware of the longer less-broadly proportioned wings of the Fulmar and the characteristic odor of petrels. On the other

hand, distinguishing a dark phase fulmar from a dark shearwater (particularly Sooty Shearwater) does take some experience. A rounder tarsus, and in many specimens, bluish or pale yellow-greenish feet, would identify the bird as a fulmar. Identification should be confirmed with someone experienced in identifying such specimens in the hand.

SHEARWATERS (PROCELLARIIDAE, subfamily PUFFININAE)

Except perhaps in the Bering Sea, shearwaters as a group are among the most abundant seabirds, if not the most abundant species, in waters off western North American coasts. Their bodies and wings are quite similar in proportion, size and shape to fulmars. Sometimes, especially in headless specimens, the all dark shearwaters are hard to distinguish from dark phase fulmars (see comments under Northern Fulmar). Otherwise their longer, much more slender bill, much smaller nasal tube which is clearly separated into two passages (Plate 5-5), and flatter-sided tarsi separate them from any fulmar. Shearwaters are about the same general size as many ducks and are smaller than the typical "sea gull".

Shearwaters are rather conservative in coloration. Except for Buller's Shearwater, those occurring here are dark brown above, and dark brown or white below. Important characters to note are size, color of bill and feet, and color of undertail and underwing coverts.

PINK-FOOTED SHEARWATER (*Puffinus creatopus*; choice 18', pg. 30). The light colored feet and bill and dark undertail coverts, in conjunction with the dark upperparts and white breast and belly would separate a specimen of this species from any other that could be encountered except the much smaller Common Shearwater. Pink-footed Shearwaters occur here mostly during summer and early fall but specimens have been found during the winter. They are most abundant south of central California but have been reported as far north as southeast Alaska, where they occur regularly but in small numbers.

FLESH-FOOTED SHEARWATER (*Puffinus carneipes*; choice 19, pg. 30) is identical to the Pink-footed Shearwater except for its completely dark underparts. Its occurrence patterns are also the same except that it is far less numerous. Any specimen encountered should be saved.

BULLER'S (NEW ZEALAND) SHEARWATER (*Puffinus bulleri*; choice 16, pg. 29) is the only strikingly colored shearwater off this coast. It is white below and pearl gray above except for a black cap and a black "W" across its wings and back. In specimens of very worn plumage, it is very similar to the Streaked Shearwater. The fact that the inner webs of primaries are extensively white in Buller's Shearwater would separate such specimens from the latter in which the inner webs are dark.

During the late summer and early fall of some years, Buller's Shearwaters are rather common in coastal waters from central California north to British Columbia. Rarely they occur north or south of there. Any specimens from the Aleutians, Bering Sea or Baja California should certainly be saved for verification. On rare occasions this species has occurred in west coast waters during the winter.

STREAKED SHEARWATER (*Puffinus leucomelas*; choice 18, pg. 30). Only a few records are known for the area, all in central California. The only difficulty in keying out a specimen, with or without a head, would arise when plumage is worn. The color of the undertail coverts and of the inner webs of primaries, and the wing length would then be critical in separating this species from Common, Pink-footed, and Buller's Shearwaters.

SOOTY SHEARWATER (*Puffinus griseus*; choice 20', pg. 30) is distinguishable from other all dark shearwaters mainly on the basis of size. It is smaller than the Flesh-footed and larger than the Short-tailed Shearwater. The light coloration to feet and bill in the first and the generally darker wing linings in the second are additional clues for separating these, respectively, from Sooty Shearwaters.

During most summers and early falls, the Sooty Shearwater ranks among the most abundant birds occurring in coastal waters of western North America, especially from southeast Alaska southward. They occur at other times of the year in low numbers but when any dark shearwater is found among the Aleutians or in the Bering Sea at any time or elsewhere during winter and early spring, the Short-tailed Shearwater should be strongly considered.

SHORT-TAILED SHEARWATER (*Puffinus tenuirostris*; choice 20, pg. 30) is a smaller, slightly more delicately proportioned version of the preceding species. It is abundant in the Bering Sea and in the vicinity of the Aleutian Islands during summer and fall; its numbers drop off rapidly to the south but it has occurred as far south as Baja California. South of Washington they are rather uncommon, and specimens south of California or even central California should be saved for verification. It is more likely that dark shearwaters encountered along the west coast after November are this species rather than the Sooty Shearwater.

MANX (COMMON) SHEARWATER (*Puffinus puffinus*; choice 17, pg. 29). This species' small size should distinguish it from other white-bellied shearwaters occurring off the North American west coast. It occurs quite regularly in Baja and southern California coastal waters during fall and winter and should be expected at other times of the year as well. During fall and winter it has occurred regularly but in small numbers north to central California. One should expect the occasional specimen as far north as southeast Alaska, but north of central California specimens should be saved for verification.

There are actually two forms of this bird that occur along the Pacific coast; controversy exists over whether they are subspecies of a bird that occurs world wide in subtropical and tropical waters ("Common" Shearwater) or whether one (Black-vented Shearwater, *P. opisthomelas* or *P.p. opisthomelas*) or the other (Townsend's Shearwater, *P. townsendi* or *P.p. townsendi*), or both, are distinct species. Little is known about the marine distribution of the Townsend's Shearwater; probably(?) it does not occur very far north along the Baja California coast. Whenever any specimen of the "Common" Shearwater is found, every attempt should be made to determine whether it is a Townsend's or a Black-vented Shearwater. If a Townsend's then without doubt the specimen should be saved, regardless of locality, and donated to a major museum.

The two shearwaters can be separated by several characters. In Townsend's, the undertail coverts are white (sometimes some are mottled brown and white), the crown is black (not a good character in an old or worn specimen), the side of the upper breast is only slightly mottled, and it is smaller (see table below). In Black-vented, the undertail coverts are brown, the crown and other upper parts are browner, the upper breast is mottled, and it is larger. The following measurements (in mm) were taken from Murphy (1952):

	<u>Townsend's</u>	<u>Black-vented</u>
Culmen	28-35	34-42
Wing	220-238	214-251
Tarsus	42-47	43-56

GADFLY PETRELS (PROCELLARIIDAE, subfamily PUFFININAE)

SCALED (MOTTLED) PETREL (*Pterodroma inexpectata*; choice 11, pg. 28). The stout and heavy bill makes this petrel superficially similar to the fulmarine petrels (Plate 5). No other petrel, or seabird, that would likely be encountered in the area has the distinctive underwing color pattern of this one (see keys). It is a strong possibility that Cook's Petrel (*Pterodroma cookii*; Plate 5) will be recorded soon in Baja California or southern California waters. Its completely white underwing linings and belly would distinguish it from the Mottled Petrel.

Mottled Petrels could be found at any time of year. Great numbers are present in summer but for some reason most beach specimens have occurred in winter and spring. They occur in small numbers in the Aleutian and southeast Alaska areas and in even smaller numbers as far south as central California along this coast. Any specimens encountered south of Alaska should be saved.

STORM PETRELS (HYDROBATIDAE)

This group includes the smallest seabird. Some are as small as sparrows and others no larger than robins. Except for one species, all are dark brown or gray with or without white rump feathers. If only a wing is found, identification will be difficult and should be confirmed by someone very familiar with these birds. For that matter, even the identification of entire specimens would best be confirmed by an experienced person.

FORK TAILED STORM-PETREL (*Oceanodroma furcata*; choice 2, pg. 27). Because these birds are pearl gray they cannot be confused with other species of storm-petrels occurring off the coast. North of central California, and into the Bering Sea, they should be expected at any time of year in ice-free areas. South of this region they are more likely to occur during winter but only on rare occasions.

LEACH'S STORM PETREL (*Oceanodroma leucorhoa*; choice 7 and 8', pg. 28). This species' size and the dark central feathers in its otherwise white rump should distinguish it from other white-rumped species. Unlike other storm-petrels, from central California south, the rump color of Leach's Storm-Petrels varies tremendously from totally white to totally dark. The greatest difficulty will be in distinguishing dark-rumped Leach's from other dark-rumped species. Careful consideration of characters mentioned in the key should suffice in most cases.

North of central California this and the previous species are the only storm-petrels that one should expect to encounter. Leach's Storm-Petrels rarely occur in the Bering Sea even though they breed on many of the Aleutian Islands. From central California north one should find them only during the spring, summer, and early fall. To the south, as far as Baja California, they could be encountered year round.

BLACK STORM PETREL (*Oceanodroma melania*; choice 3, pg. 27) is the largest of the all dark storm-petrels off this coast and size alone should distinguish it from any other species. It occurs in southern and Baja California waters mainly from spring to fall although winter occurrences would not be unusual. North to central California they occur quite regularly during late summer and fall. From there north, specimens should be saved for verification.

ASHY STORM PETREL (*Oceanodroma homochroa*; choice 9', pg. 28) is the all dark species most similar to the all dark Leach's Storm-Petrel. The fact that it is ashy gray (especially at tips of tertials and secondary coverts), fading in the late summer to brown, should separate it from Leach's which is dark chocolate brown and fades to lighter brown. The underwing coverts are the best to check for these color differences, since fading does not occur very much there. The buffy bar running through the upper wing coverts is much more prominent in Leach's Storm-Petrel. Experience in distinguishing these two birds in the hand helps a great deal since it is not necessarily an easy undertaking.

Ashy Storm Petrels occur year round from northern Baja California to central California, and in the fall sometimes occur in northern California waters.

GALAPAGOS STORM PETREL (*Oceanodroma tethys*; choice 6, pg. 27), is a very small white-rumped species that is most easily confused with small, white-rumped Leach's Storm-Petrels from Guadalupe Island, off the central Baja California coast. The size of the rump patch relative to the tail length, as described in the keys, should be checked carefully. When checking tail length be sure to note whether feathers are still growing.

On only a few occasions has this species been reported in waters off this coast and never north of central California. All specimens should definitely be saved for verification.

HARCOURT'S STORM PETREL (*Oceanodroma castro*; choice 7', pg. 28) has been reported in this region only at sea off southern Baja California. The white bases of tail feathers should separate any specimen from other white-rumped species.

LEAST STORM PETREL (*Halocyptena microsoma*; choice 9, pg. 28). The extremely small size should separate any specimen of this species from any of the other all dark storm-petrels. The square or even rounded tail is also distinctive.

Least Storm Petrels occur quite commonly from Baja California north to southern California. They have been reported as far north as northern California. Off Baja they occur during the spring to fall period, but north of there, occurrence is pretty much restricted to the fall.

WILSON'S STORM PETREL (*Oceanites oceanicus*; choice 5, pg. 27). The very long tarsi, yellow-webbed large feet, and white lower belly (as well as rump) are characteristics of this species that collectively should set it apart from any others. This visitor from the Southern Hemisphere occurs regularly but in extremely small numbers in west coast waters, mainly during the fall. It has been reported at least as far north as Washington. Any specimens should be saved for verification.

TROPICBIRDS (PHAETHONTIDAE)

RED-BILLED TROPICBIRD (*Phaethon aethereus*; choice 13, pg. 21). About the size of a Western Gull, these birds are largely white all over except for fine, black barring on upper parts. Primary wing coverts are black, as is the upper surface of the outer 5 primaries. The bill is very heavy but similar in shape to that of a Caspian Tern (compare Plates 4-2 and 29-1). In adults the bill is scarlet but in juveniles it is yellow. The feet are black.

CASPIAN TERN (*Sterna caspia*; choices 9 and 9', pg. 63). Like the latter two, this species is quite distinctive from other terns, particularly because of its size. If one picked up a Red-billed Tropicbird, until a closer look was made, the Caspian Tern would probably be the first name to come to mind. They both are very light in coloration, are of similar size, and have large heavily proportioned red bills; compare Plates 4 and 29. It is, of course, far more likely to find a Caspian Tern in North American coastal waters than it is a tropicbird.

This species can be found year round in coastal waters from southern California southward, but more so during fall and winter. It occurs rather rarely along the Pacific coasts of Oregon and Washington during spring and fall migrations.

BLACK TERN (*Chlidonias nigra*; choices 3 and 3', pg. 62). An adult of this species is superficially similar to a juvenile Sooty Tern, but the larger size and buffy feather margins of the latter would readily separate the two species.

Black Terns wander a good deal and thus one might conceivably encounter one in coastal waters as far north as Washington. Finding one is much more likely from California southward. The species breeds inland and winters from Panama southward. Thus it would occur off here mainly during migration, and especially the fall.

SKIMMERS (RYNCHOPIDAE)

BLACK SKIMMER (*Rynchops niger*; choices 6 and 6', pg. 62). Except for its very distinctive bill (Plate 29), this bird is similar in morphology to terns. There should be no problem in distinguishing a specimen of this species.

Black Skimmers breed coastally in southern California on San Diego Bay. In the region covered by this manual, one is most likely to find them from southern California southward and very rarely as far north as central California. Any specimen found should be saved for verification.

ALCIDS or AUKS (ALCIDAE)

Auks are compact and, compared to their wing size, rather heavy-bodied birds. Their wings are surprisingly narrow, as in a petrel, but are rounded rather than pointed. Many auk species have a brightly colored bill, mouth lining and feet (colors include yellow, orange, bright red and blue). They can offer some of the most difficult problems in identification for two reasons. First, the young of larger species are superficially similar in size and shape to adults of smaller species. The young of most seabirds leave the nest or nesting island when "adult-sized" but the young of some alcids leave nesting islands when very small and in some cases when just a few days old. Many times young murrelets have been identified as murrelets. Second, most morphological variation among auks is confined to differences in size and in head characteristics. Thus in a headless specimen only size and some subtle color differences can offer clues to identification.

COMMON MURRE (*Uria aalae*; choices 6', 7, 23 and 24, pp. 66, 70-71) and THICK-BILLED MURRE (*U. lomvia*; choices 6, 7', 23 and 24, pp. 60, 70-71). If the specimen has a head, one should have little difficulty in separating these two species. If it has no head then the task is not as easy.

Both species breed abundantly from the Bering Straits to western Alaska, and the Common Murre from there to central California. During the non-breeding period, Common Murres occur from ice free Bering Sea waters to northern Baja California. Thick-billed Murres winter as far south as southeast Alaska and regularly but very rarely to central California. Any Thick-billed Murre specimen encountered south of southeast Alaska should be saved for verification. Young murres begin their sea-lives when only a quarter the size of adults.

BLACK GUILLEMOT (*Cepphus grylle*; choices 4 and 4', pg. 66) and PIGEON GUILLEMOT (*C. columba*; choices 10 and 10', pg. 69). Wing color is the major character by which these two species can be separated. Size measurements can also be useful, as the following table shows (from Storer, R. W., 1952) for specimens from the Bering Sea, where the two overlap in distribution (measurements in mm):

	<u>BLACK GUILLEMOT</u>	<u>PIGEON GUILLEMOT</u>
Wing	165-175	174-195
Tarsus	27-34	31-38
Culmen	27-35	31-37

The two species occur year round as far north as ice free waters exist. The Black Guillemot does not occur south of the Bering Sea but the Pigeon Guillemot occurs as far south as southern California. During the late fall and winter, Pigeon Guillemots are uncommon in coastal waters south of British Columbia.

MARbled MURRELET (*Brachyramphus marmoratus*; choices 30 and 30', pp. 71-72), KITTLITZ'S MURRELET (*B. brevirostris*; choices 28 and 28', pg. 71), and ANCIENT MURRELET (*Synthliboramphus antiquum* choices 20 and 20', pg. 70). One should have no difficulty in distinguishing these species from one another, or from other murrelets, unless only part of a specimen is available. The following table (based on Sealy, 1972; Jehl and Bond, 1976; Bedard, 1969; and Ridgeway, 1919) may be useful (measurements in mm):

	<u>MURRELETS</u>				
	<u>Marbled</u>	<u>Kittlitz's</u> ^{1/}	<u>Ancient</u>	<u>Xantus'</u>	<u>Craveri's</u>
Wing	120-140	127-141	132-149	111-128	107-124
Tarsus	13.9-17.6	15.5-16.5	24.6-28.0	21.2-27.5	21.0-24.5
Exposed					
Culmen	13.2-17.6	9.5-10.5	12.2-15.1	15.6-21.4	18.0-22.5
Bill					
Depth	5.3-7.0	5.1	6.4-8.5	6.2-6.5	4.6-5.9

^{1/} Based on few specimens. range in measurements may be slightly greater;

Marbled Murrelets occur year round from southeast Alaska to central California and during fall and winter to southern California. Kittlitz's Murrelets occur year round, where ice free waters exist, from the Bering Strait to southeast Alaska (one extralimital record from San Diego). Ancient Murrelets occur year round from the southern Bering Sea to British Columbia, and during the winter to northern Baja California. Any specimens of Marbled Murrelet south of the Channel Islands, or of Kittlitz's Murrelet south of southeast Alaska, should be saved for verification.

XANTUS' MURRELET (*Endomychura hypoleuca*; choice 19', pg. 70) and CRAVERI'S MURRELET (*E. craveri*; choice 23', pg. 71). Of the five murrelets these two are the most plainly marked. They closely resemble the murras, except in size; compare Figs. 25 and 26. Chicks accompany adults to sea when only a few days old and when feathered only in down. The above table of measurements may aid in identification, but be wary of the fact that only adults are included.

The Xantus' Murrelet may be found year round in Baja California and southern California waters. During early spring and late summer they occur as far north as Washington but in any abundance only as far north as central California. The occurrence of Craveri's Murrelet is quite similar to the Xantus' but the Craveri's Murrelet is less abundant along the Pacific coast than the other. Any specimen of Xantus' Murrelet north of central California and of Craveri's Murrelet north of Pt. Conception should certainly be saved for verification.

CASSIN'S AUKLET (*Ptychoramphus aleuticus*; choice 22, pg. 70). Little more can be added than what is in the keys to aid in distinguishing the five auklets. One should have little difficulty in doing so, unless the specimen is headless. The following table (based mostly on Ridgway, 1919) may at times be useful (measurements in mm), but consider the fact that first year auklets (measurements not in table) are slightly smaller than adults:

	AUKLETS				
	Cassin's	Parakeet	Crested	Least	Whiskered
Wing	109-129	140-156	125-145	88-98	103-118
Tarsus	23-25	26-31	24-30	16-20	19-24
Exposed					
Culmen	18-20	13-17	10-14	7-10	7-10

Cassin's Auklet is the most widely distributed of the five auklets. It occurs year round from islands off the Alaska Peninsula south to central Baja California. Any specimens from the Bering Sea should be saved for verification.

PARAKEET AUKLET (*Cyclorhynchus psittacula*; choices 33 and 33', pg. 72), CRESTED AUKLET (*Aethia cristatella*; choices 32 and 32', pg. 72) LEAST AUKLET (*A. pusilla*; choices 18 and 18', pg. 70) and WHISKERED AUKLET (*A. pygmaea*; choices 26 and 26', pg. 71). See comments regarding identification under Cassin's Auklet. These four species are largely restricted to ice free areas of the Bering Sea, waters around the Aleutians and eastward almost to Kodiak, Alaska. Parakeet Auklets on rare occasions have occurred as far south as central California. Specimens of any of these species encountered south of southeast Alaska, or even Kodiak, should be saved for verification.

RHINOCEROS AUKLET (*Cerorhinca monocerata*; choices 14 and 14', pg. 69) This species is most similar to the first year Tufted Puffin, but characters in the key, the darker belly and deeper bill of the latter should distinguish them (Plates 31-1, 32). See table under Horned Puffin.

Rhinoceros Auklets occur year round from southeast Alaska to central California, and during winter to southern California.

HORNED PUFFIN (*Fratercula corniculata*; choices 15 and 15', pg. 69) This species cannot be easily confused with the Rhinoceros Auklet or the Tufted Puffin, the species to which it is most similar. The following table (from Ridgway, 1919) may be of use (measurements in mm):

	<u>Rhinoceros Auklet</u>	<u>Horned Puffin</u>	<u>Tufted Puffin</u>
Wing	169-190	182-222	189-236
Tarsus	25-30	25-38	29-36
Exposed Culmen	32-39	45-56	53-65

Horned Puffins occur year round, in ice free waters, from the Bering Strait south to British Columbia. They occur infrequently as far south as southern California, but regularly to central California, during the period from late winter to early summer.

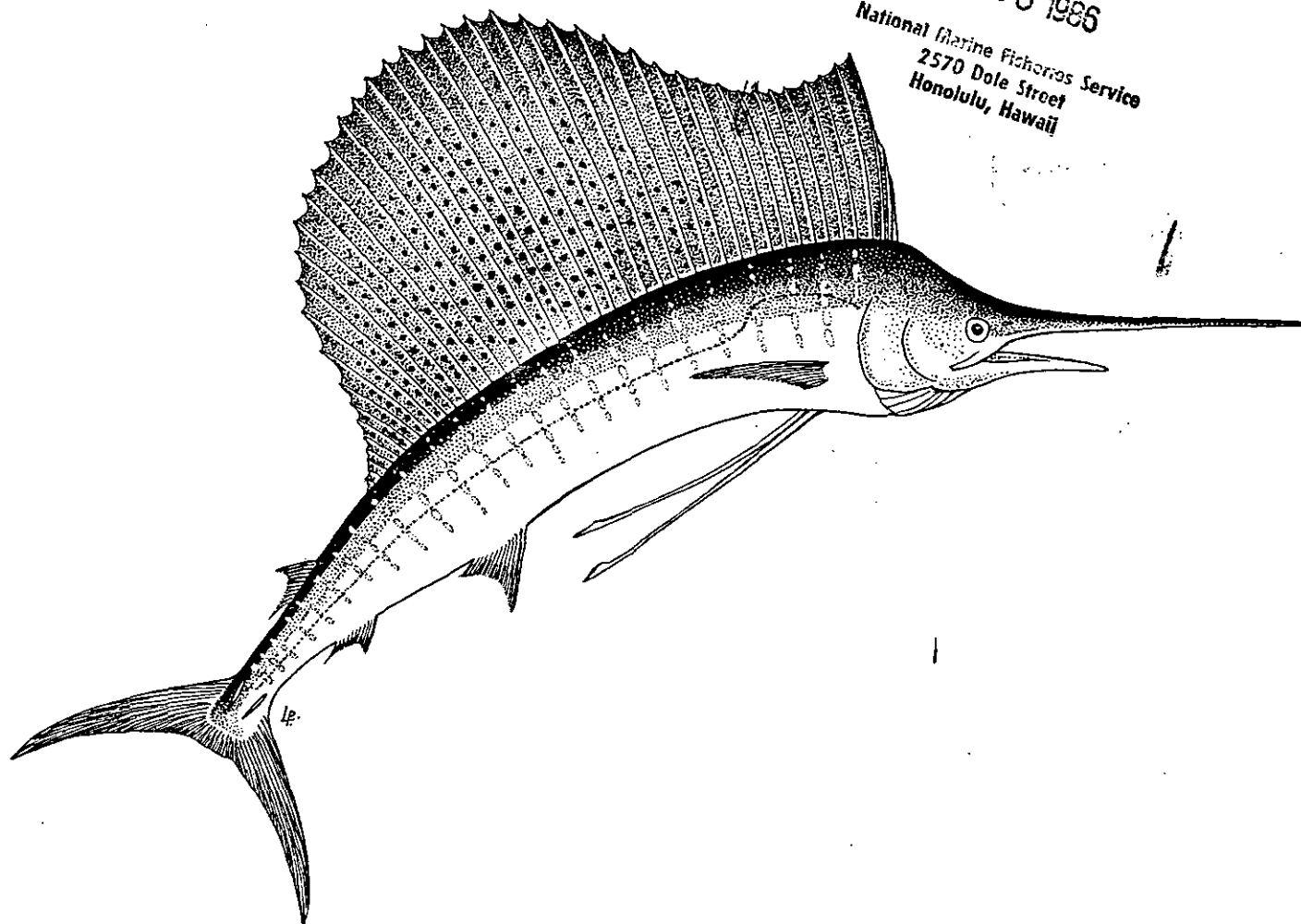
TUFTED PUFFIN (*Lunda cirrhata*; choices 12 and 12', pg. 69). For comments on identification see the above two species. Tufted Puffins occur year round, in ice free waters, from the Bering Strait south to central California; south of British Columbia they are rather uncommon. On rare occasions they occur in southern California waters although not long ago they bred in very low numbers on the northern Channel Islands.



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National Marine Fisheries Service
2570 Dole Street
Honolulu, Hawaii



UNITED NATIONS DEVELOPMENT PROGRAMME
FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS



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Rome 1985

1.3 Illustrated Glossary of Technical Terms and Measurements

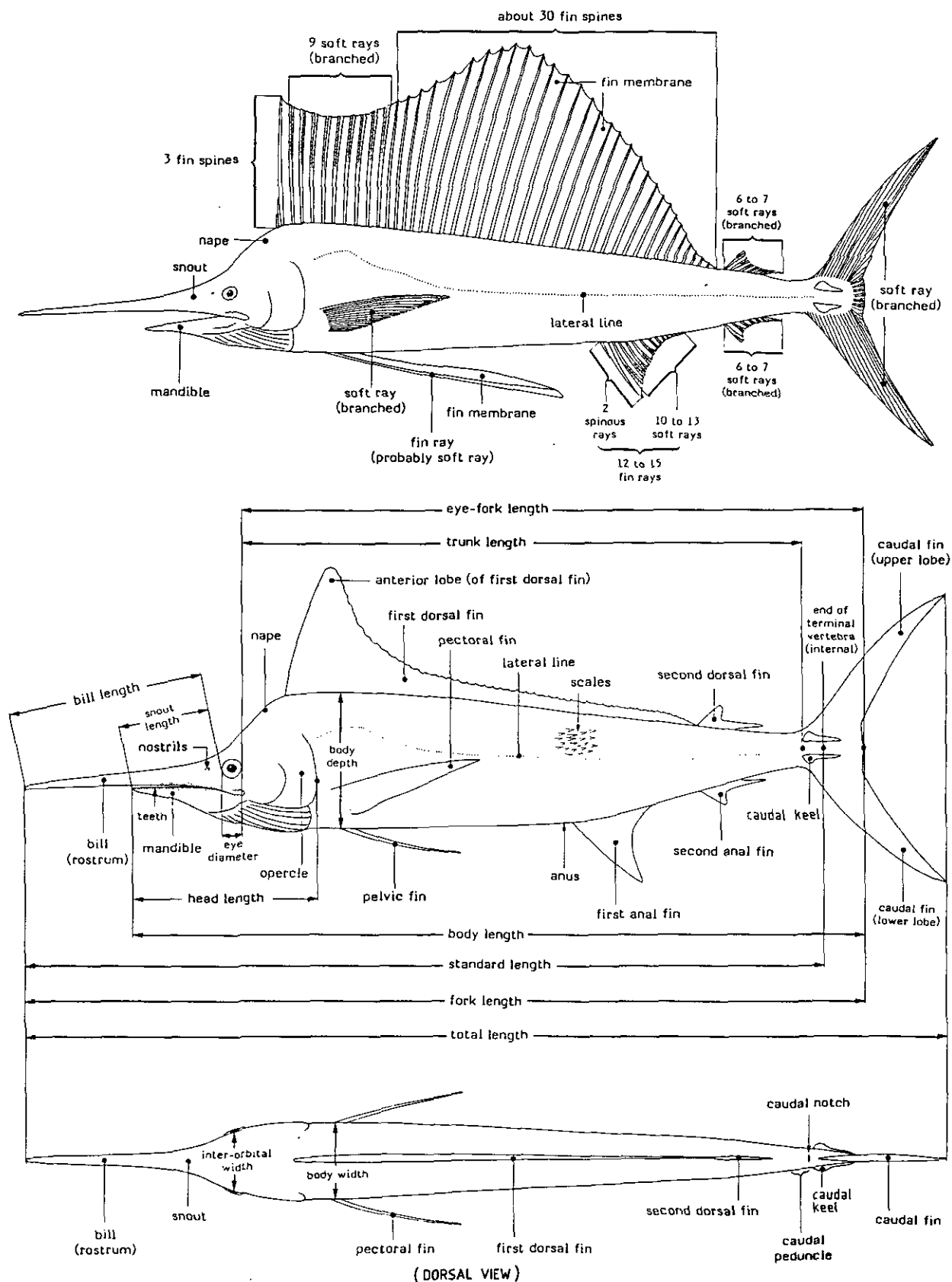
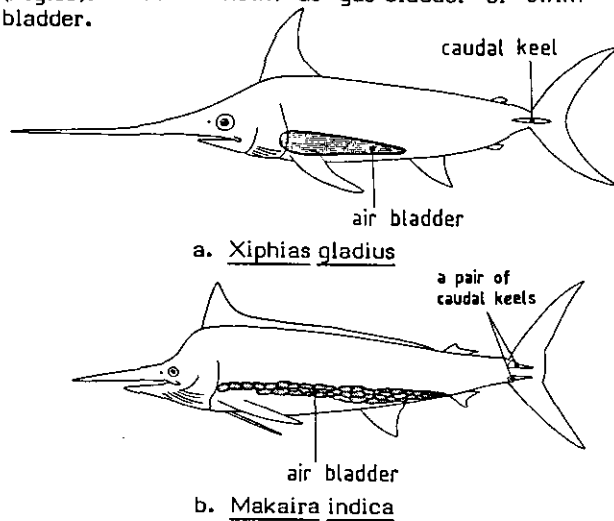


Fig.7 Schematic illustration of Indo-Pacific sailfish, *Istiophorus platypterus* (above) and a striped marlin, *Tetrapturus audax* (middle and below)

All measurements are straight line distances. For detail of measurements, see Rives (1956) and Nakamura (1983)

Air-bladder - Membranous sac filled with air or other gases lying in the abdomen just beneath the vertebrae. The swordfish's air-bladder consists of a single chamber (Fig.8a), while that of istiophorids is made up of many bubble-shaped, small chambers (Fig.8b). Also known as gas-bladder or swim-bladder.

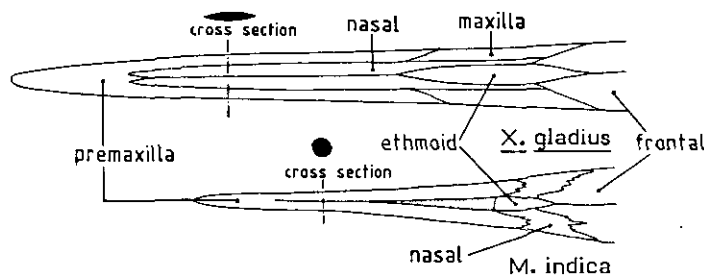


Schematic illustration of air-bladder and caudal keels **Fig.8**

Anal fin(s) - The fin(s) on the ventral median line of the body behind the anus (Fig.7).

Anus - External opening of the intestine, situated on the ventral midline of the body (Fig.7). The relative position of the anus to the first anal fin is important in istiophorid taxonomy. Also known as vent.

Bill - Long, slender upper jaw. Both jaws are elongate, but the upper is longer than the lower in billfishes. The bill is flat in the swordfish and round in istiophorids (Figs 7,9).



Bill structure in dorsal view (schematic) **Fig.9**

Bill length - Measured from the tip of the bill to the anteriormost point on the fleshy margin of the orbit (Fig.7).

Body depth - Greatest depth of body (Fig.7). Body depth at origin of pectoral fins, pelvic fins, and first anal fin is sometimes also used.

Body length - Measured from the tip of the lower jaw (with the jaws closed) to the posterior margin of the middle caudal rays (Fig.7). In other fishes the measurement, "body length" is usually "standard length". In billfish taxonomy, this dimension is used following Rivas (1956).

Body width - Greatest width of body (Fig.7). Body width at origin of pectoral fins, pelvic fins and first anal fin is sometimes also used.

Branchiostegal (rays) - Strut- or ray-like bones attached to the hyoid arch, connected by the branchiostegal membrane (Figs 15,16,22).

Branchiostegal membrane - The membrane connecting the branchiostegals and enclosing the gill chamber ventrally (Figs 15,16,22).

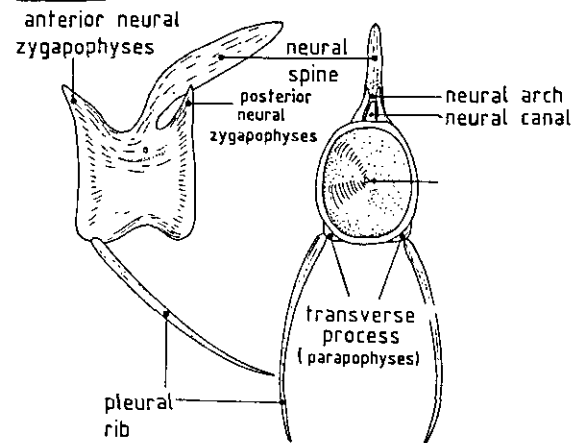
Caudal fin - Median fin situated at the posterior end of the body, consisting of an upper and a lower lobe (Fig.7).

Caudal keel - Xiphiidae have a large median caudal keel (Fig.8a) and istiophorids have a pair of caudal keels (Fig.8b) on the middle of the caudal peduncle.

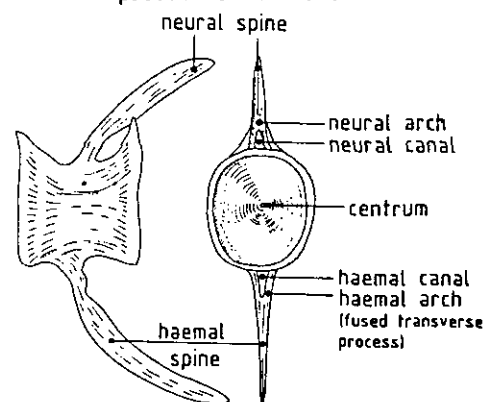
Caudal notch - An elongate, small pit on dorsal and ventral margins of the caudal peduncle (Fig.7). The caudal notch is shallow and small in istiophorids, and deep and rather large in *Xiphias*.

Caudal peduncle - The narrow part of the body between the posterior ends of the dorsal and anal fins and the base of the caudal fin (Fig.7).

Caudal vertebrae - Vertebrae that bear a haemal spine ventral to the vertebral centrum (Fig.10b). Caudal vertebrae lack pleural ribs. The number of caudal vertebrae is 15 or 16 in *Xiphias*, 12 in *Istiophorus* and *Tetrapturus*, and 13 in *Makaira*.



a. precaudal vertebrae



b. caudal vertebrae

Schematic illustration of vertebrae of *Xiphias gladius*

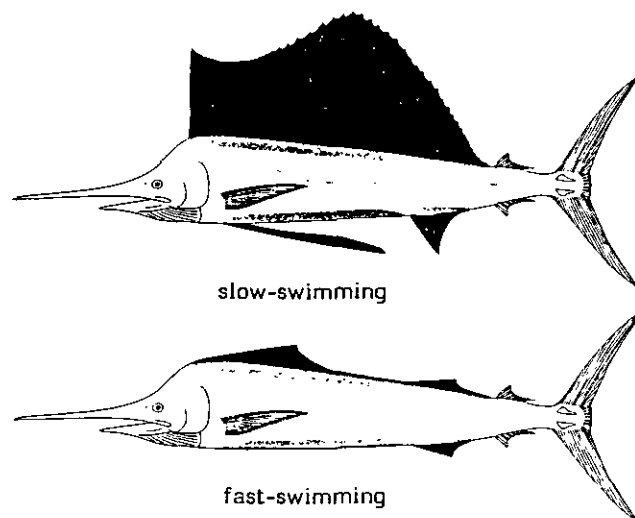
Dorsal fin(s) - Fin(s) on the back of a fish (Fig.7). Billfishes have two dorsal fins.

Ethmoid - Unpaired skull bone on the anterior part of the neurocranium (Fig.9).

Eye diameter - Measured as the greatest distance across the cornea, that is, between the margins of the cartilaginous eyeball (Fig.7).

Eye-fork length - Measured from the posterior edge of the orbit to the posterior margin of the middle caudal rays (Fig.7). This dimension is frequently used by Japanese fishery biologists because it is useful in specimens with bills cut at fish markets or on fishing boats.

Fin grooves - The first dorsal, first anal and pelvic fins fold down into grooves in all istiophorids when they are swimming rapidly (Fig.11). Fin grooves are not developed in *Xiphias gladius*.



Schematic illustration of fin grooves (shaded areas) in *Istiophorus platypterus*

Fig.11

Fin membranes - The thin membranes between the rays of the fins (Fig.7).

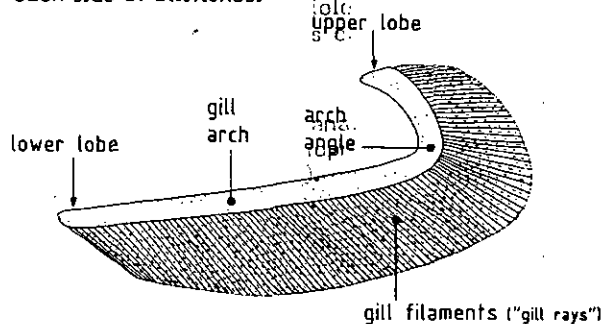
Fin rays - General term for the soft rays and spines (spinous rays) that support the fins (Fig.7). Soft rays are branched, segmented or paired (left and right elements united). Spines are unsegmented fin supports, unbranched, unpaired and usually stiff and sharply pointed.

Fin spines - Sharp, pungent and pointed structures (Fig.7). Usually called merely spines.

Fork length - Measured from the tip of the bill (upper jaw) to the posterior margin of the middle caudal rays (Fig.7). Usually used for scombroid (particularly tunas) studies, because the caudal fork area is very strong, in tunas as well as in billfishes and the snout is not prolonged in tunas.

Frontals - Paired skull bones in middle part of the neurocranium (Figs 9,16).

Gill arch - The J-shaped structure under the gill cover that bears the gill filaments and normally the gillrakers, but the billfishes lack gillrakers (Fig. 12). There are 4 gill arches on each side of billfishes.



first gill arch of *Xiphias gladius* (schematic)

Fig.12

Gill filaments - Organ for aquatic respiration. In billfishes the gill filaments are ossified as "gill rays" as in the case of tunas (Fig.12); see also Iwai & Nakamura (1964).

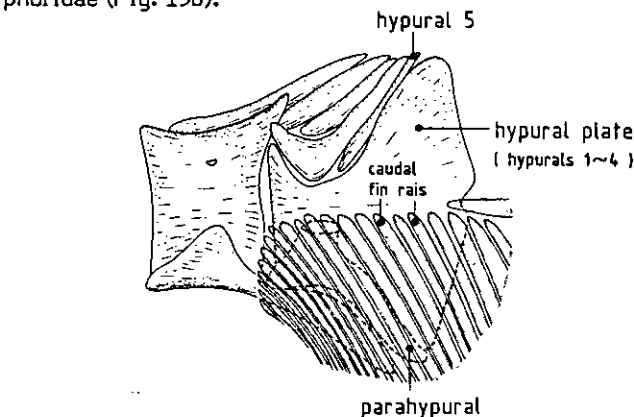
Haemal arch - The arch that is formed above the fused distal ends of the haemal spines of caudal vertebrae (Fig.10b).

Haemal canal - The canal for the blood vessel, formed by the haemal arch of caudal vertebrae (Fig.10b).

Haemal spines - The spines that extend ventrally from the centra of a caudal vertebra (Fig.10b). The first vertebra with a haemal spine is the first caudal vertebra.

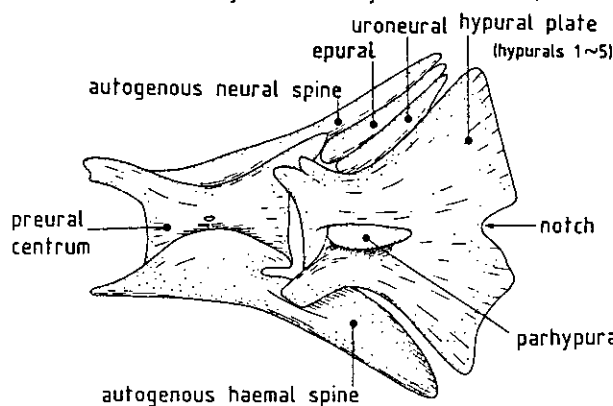
Head length - Measured from the tip of the mandible (lower jaw) to the most distant point on the opercular membrane (Fig.7).

Hypural plate - The expanded ends of the hypural bones form a wide, fan-like plate onto which the caudal fin rays insert distally. Like tunas, billfishes differ from most other fishes in having the caudal fin rays so deeply divided that they completely cover the hypural plate; the hypural plate consists of four hypural bones in *Xiphias* (Fig.13a) and five in Istiophoridae (Fig. 13b).



a. *Xiphias gladius*

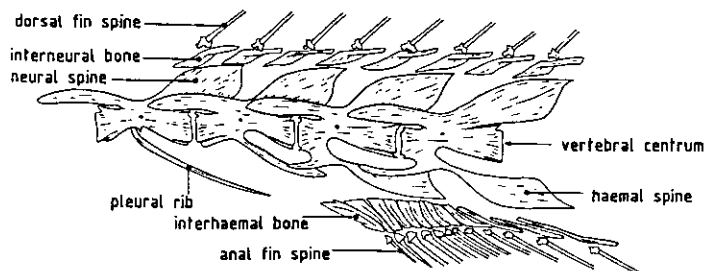
(Caudal fin rays shown only on lower half)



b. *Istiophorus platypterus*

Schematic drawing of hypural plate Fig.13

Interhaemal bones - The bones situated between the haemal spines of the vertebrae and the spines or rays of the anal fin (Fig.14).

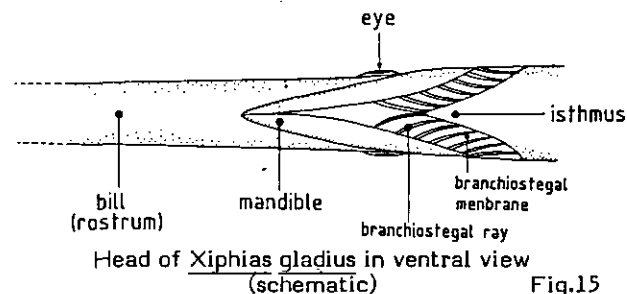


Position of interneural and interhaemal bones in *Istiophorus platypterus* (schematic) Fig.14

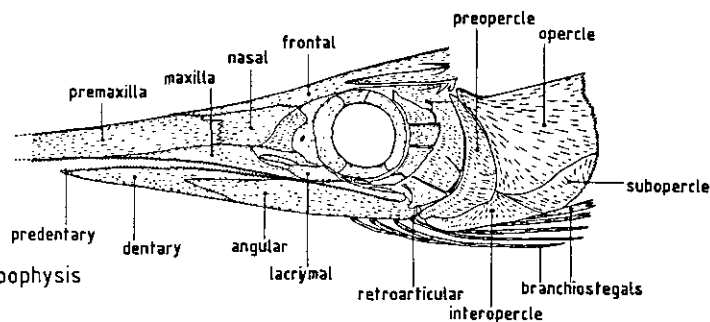
Interneural bones - The bones situated between the neural spines of the vertebrae and the spines or rays of the dorsal fin (Fig.14).

Interorbital width - Measured as the shortest distance between the fleshy margins of the orbits (Fig.7).

Isthmus - Ventral fleshy area on the throat between the gills (Fig.15).

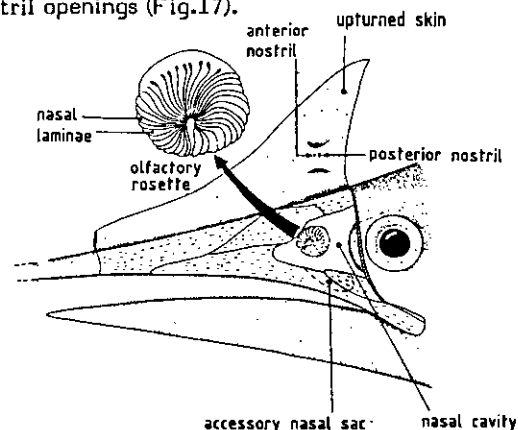


Lacrymal bone - The largest of the infra-orbital series of bones, located ventrad and slightly anterior to the eye (Fig.16). Also known as pre-orbital bone or first infraorbital bone.



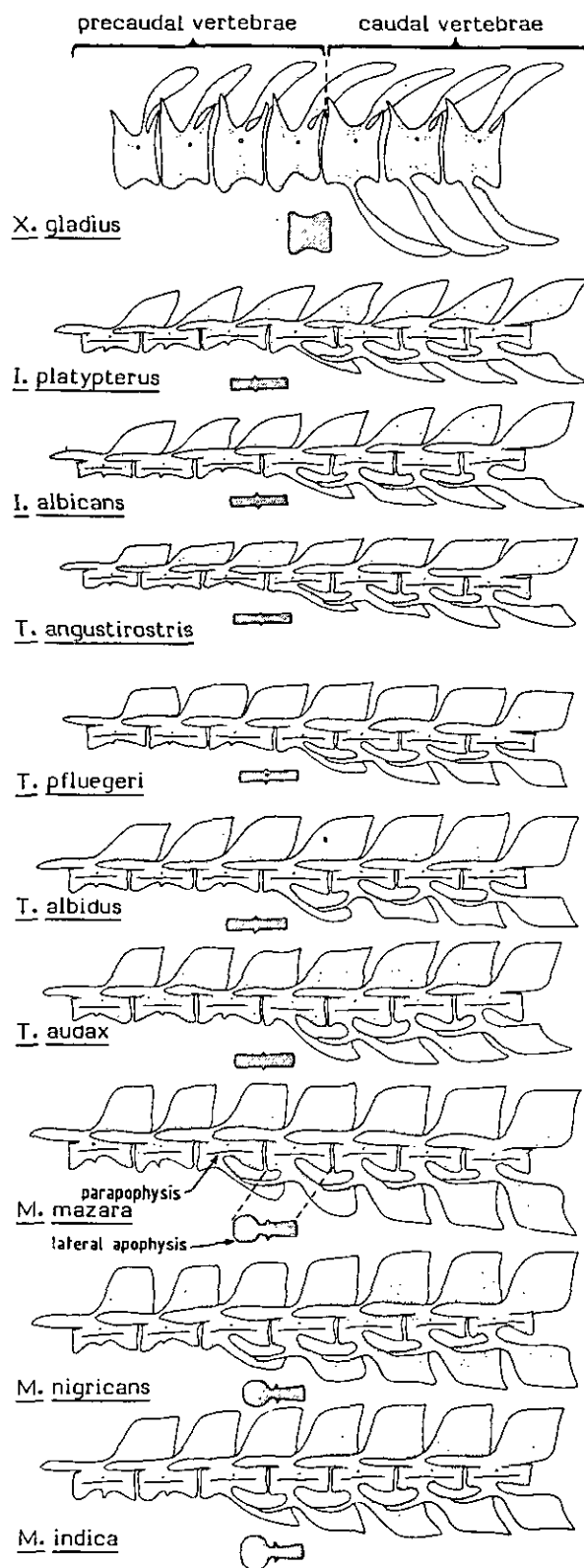
Lateral view of head skeleton of *Istiophorus platypterus* (schematic) Fig.16

Laminae of the olfactory rosette - Fleshy folds (nasal laminae) containing cells that can detect odours, arranged in a radiate pattern (rosette) beneath the skin between the anterior and posterior nostril openings (Fig.17).



Nasal cavity of *Istiophorus platypterus* after dissection (schematic) Fig.17

Lateral apophyses - The flanges that extend laterally from the anterior part of each vertebral centrum (Fig.18). Also known as the transverse flanges.



Lateral apophyses of billfish vertebrae (schematic). White areas: lateral view; black areas: ventral view

Fig.18

Lateral line - A series of sense organs enclosed in tubular scales along the sides of the body (Fig.7). The lateral line is looped in *Makaira mazara* and reticulate in *Makaira nigricans*. Other istiophorids have a single lateral line. *Xiphias gladius* has a single lateral line in immature stages which disappears in the adult.

Mandible - Known as the lower jaw (Figs 7, 15), consisting of prementary (Istiophoridae only), dentary, angular and retroarticular bones (Fig.16).

Maxilla - The supporting bone of the pre-maxilla which bears teeth in the upper jaw (Figs 9,16). The maxilla itself also bears teeth in istiophorids, unlike most other fishes.

Nape - Dorsum of the neck area immediately posterior to the head (Fig.7).

Nasals - Paired bones in the ethmoid region of the neurocranium (Figs 9,16).

Neural arch - The arch that is formed below the fused basal part of the neural spine of the vertebrae (Fig.10).

Neural canal - The canal for the nerve cord formed by the neural arch (Fig.10).

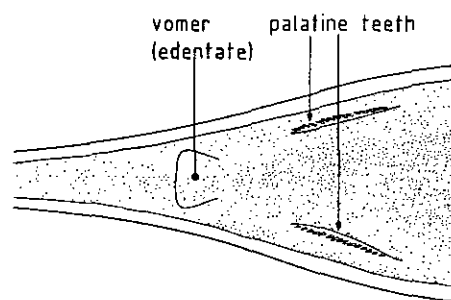
Neural spines - The spines that extend dorsally from the centra of a vertebra (Fig.10).

Nostrils - External openings of the nasal cavity. There are two (anterior and posterior) nostrils in billfishes (Figs 7,17).

Operculum - Gill cover, supported by four bones: opercle, preopercle, interopercle and subopercle (Figs 7,16).

Orbit - The eye socket (Fig.16). The sclera is ossified in billfishes.

Palatine - A pair of plow-shaped bones, the ventral margin of which lies in the roof of the mouth. The palatine bones may be toothed in istiophorids (Fig. 19), but are edentate in *Xiphias*.



Roof of mouth in *Tetrapturus albidus* (schematic)

Fig.19

Parapophyses - (Transverse processes). Projections from the ventral centra of the vertebrae (Fig.10).

Pectoral fins - Lateral paired fins behind the head (Fig.7).

Pelvic fins - Paired fins on the ventral edge of anterior body (Fig.7). Also known as ventral fins.

Precaudal vertebrae - The anterior vertebrae without haemal spines (Figs 10a,18). Also known as abdominal vertebrae. The number of precaudal vertebrae is 10 or 11 in *Xiphias*, 12 in *Istiophorus* and *Tetrapturus* and 11 in *Makaira*.

Premaxillae - Paired bones of the upper jaw, usually bearing teeth in higher teleosts and associated with the maxillae (Figs 9,16).

Prementary - Unpaired bone anterior to the dentary. Present in Istiophorids (Figs 16,22), but absent in *Xiphias*.

Rostrum - Projecting snout ;or bill (Figs 7,9).

Scales - Thin, flat, bony plates covering the body, usually cycloid or ctenoid. The scales of istiophorids do not fit into these categories, they are elongate and pungent, with sharp posterior points (Fig.7). The arrangement and shape of the scales are useful characters for the identification of billfishes. *Xiphias* has no scales in the adult stage.

Snout - Forward part of the head, anterior to the eyes and above the mouth (Fig.7).

Snout length - Measured from the tip of the mandibule (lower jaw) to the anteriormost point on the fleshy margin of the orbit (Fig.7) in billfishes.

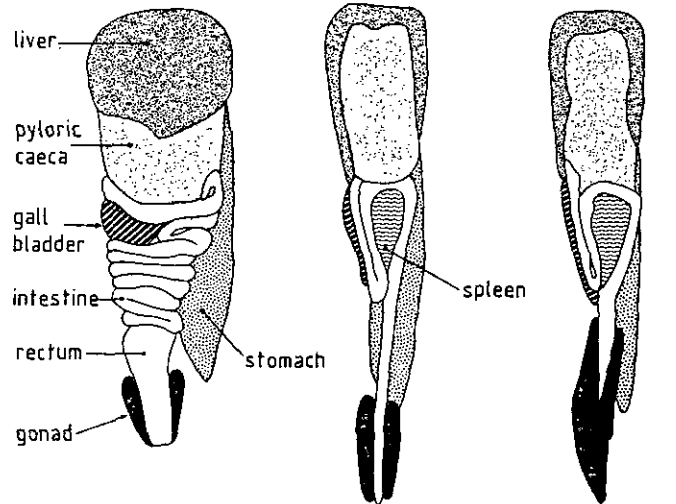
Standard length - In systematic studies, the standard length is the distance from the anteriormost part of the snout to the caudal fin base (theoretically to the end of the terminal vertebra, but this is not practical in general use) (Fig.7). In fishery studies the fork length, e.g., the distance from the anteriormost point of the head to the posterior margin of the middle caudal rays is used.

Total length - Straight-line measurement from the anteriormost to the posteriormost point of the fish (Fig.7).

Trunk length - Measured from the posterior edge of the orbit to the anterior insertion of the caudal keels (Fig.7). Used in sport-fishing.

Vertebra - One of the bony or more or less cartilaginous (in primitive fishes or young fishes) segments composing the spinal column or backbone (Figs 10,18). Number of vertebrae = number of pre-caudal vertebrae plus number of caudal vertebrae: 26 in Xiphiidae (*Xiphias*) and 24 in Istiophoridae (*Istiophorus*, *Tetrapturus* and *Makaira*).

Viscera - Internal organs of the body which are well developed in all the species of billfishes (Fig.20). The intestine is coiled, the spleen is not visible in ventral view, and the gonads are symmetrical in *Xiphias* (Fig.20a). The spleen is visible in ventral view, and the intestine is undulated in Istiophoridae (Fig.20b,c). The gonads are symmetrical in *Istiophorus* (Fig.20b), in *Makaira*, and apparently in *Tetrapturus* except *T. angustirostris* and *T. pfluegeri* where they are asymmetrical and Y-shaped (Fig.20c) (possibly also in *T. belone*).



a. *Xiphias gladius*

b. *Istiophorus platypterus*

c. *Tetrapturus angustirostris*

Viscera of billfishes in ventral view (schematic)

Fig.20

Vomer - A median skull bone, the ventral surface of which lies in the roof of the mouth. The vomer is edentate in billfishes (Fig.19), but many other fishes have vomerine teeth.

2. SYSTEMATIC CATALOGUE

2.1 Illustrated Key to Genera and Species

Xiphias

- 1a. No pelvic fins; a large median keel on each side of caudal peduncle region; snout extremely long, forming a sword-like bill, depressed in cross-section; first dorsal fin short-based, well separated from second dorsal fin in adults (Fig. 21); no scales on body nor teeth in jaws in adults; right and left branchiostegal membrane separated distally (Fig. 22a); vertebrae 26

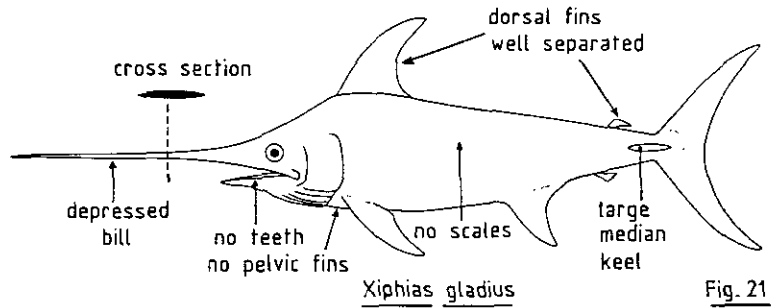


Fig. 21

Xiphias gladius
Worldwide in tropical and temperate waters

Istiophorus

- 1b. Rigid, tapering pelvic fin present; a pair of caudal keels on each side of caudal peduncle region; snout long to somewhat shorter, round in cross-section; first dorsal fin long-based, close to second dorsal fin (Fig. 23); body covered with small, elongate bony scales; rasp-like small jaw teeth present in adults; right and left branchiostegal membranes united broadly (Fig. 22b); vertebrae 24

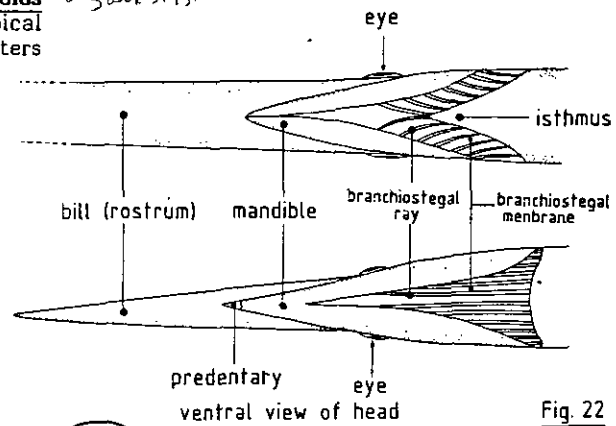


Fig. 22

- 2a. First dorsal fin (X) sail-like and remarkably higher than body depth (Y) at level of midbody; pelvic fin rays very long, nearly reaching to anal fin origin, with well developed membrane (Fig. 24)

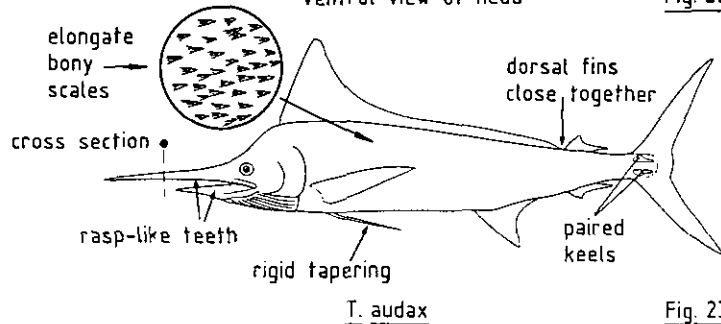


Fig. 23

- 3a. Pectoral fins and caudal fin short in immature specimens up to about 90 cm body length (Fig. 25); attains greater size (about 100 kg maximum body weight) than Atlantic sailfish

Istiophorus platypterus
Pacific and Indian oceans

- 3b. Pectoral fins and caudal fin long in immature specimens to about 90 cm body length (Fig. 26); attains smaller size (about 60 kg maximum body weight) than Indo-Pacific sailfish

Istiophorus albicans
Atlantic Ocean

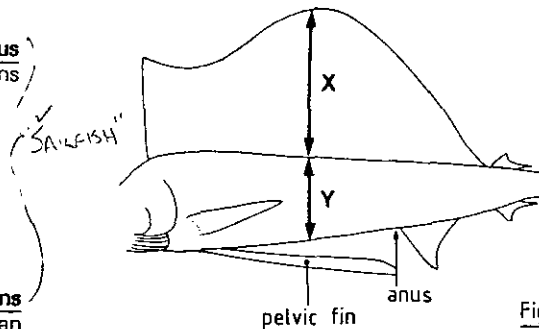
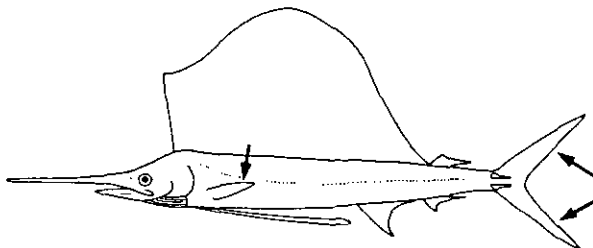
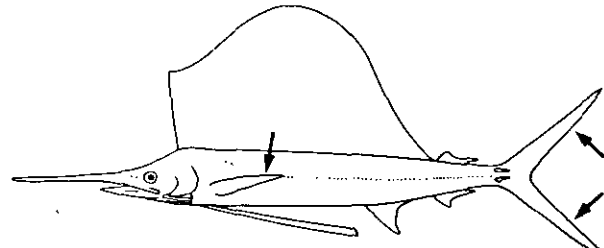


Fig. 24



I. platypterus
(immature specimen)

Fig. 25



I. albicans
(immature specimen)

Fig. 26

- 2b. First dorsal fin (X) lower than body depth (Y) at level of midbody, not sail-like; pelvic fin rays short, well separate from origin of anal fin, with moderately developed membrane (Fig. 27)

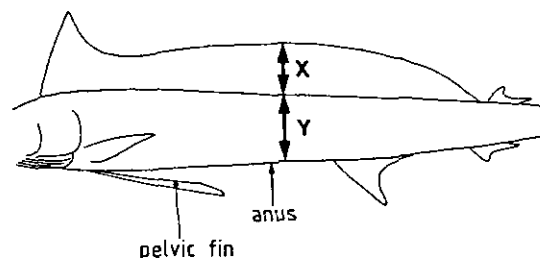


Fig. 27

- 4a. Height of anterior lobe of first dorsal fin (X) slightly greater than, or nearly equal to, body depth (Y); nape slightly elevated or not elevated (Fig. 28); body well compressed laterally; vertebrae $12+12=24$

- 5a. Anterior lobe of first dorsal fin slightly higher than rest of fin which remains of about equal height almost to the end (Figs 27,30,31,32); anus situated far anterior to first anal fin origin (Fig. 29), the distance between them (X) greater than height of first anal fin (Y)

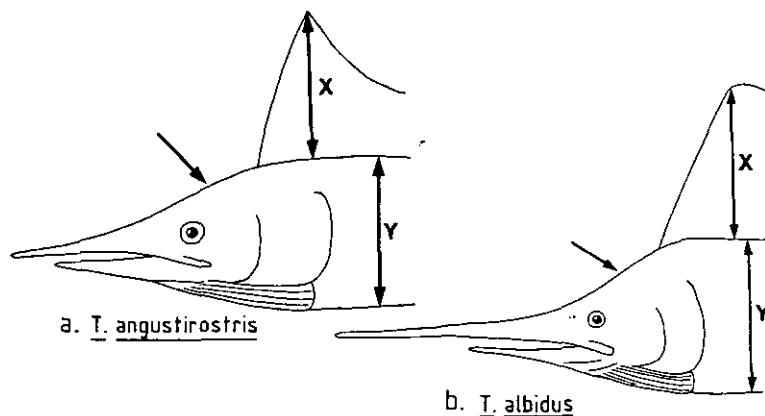


Fig. 28

- 6a. Bill short, its length (X) usually equal to, or shorter than, head length (Y); pectoral fins narrow and short, less than 18% of body length (Figs 30, 31)

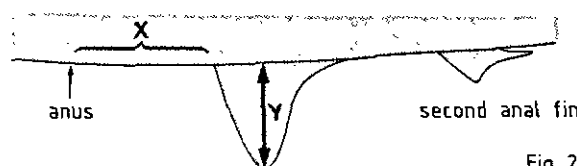


Fig. 29

- 7a. Bill very short, less than 15% of body length (Fig. 30) .. Tetrapturus angustirostris
Pacific and Indian oceans

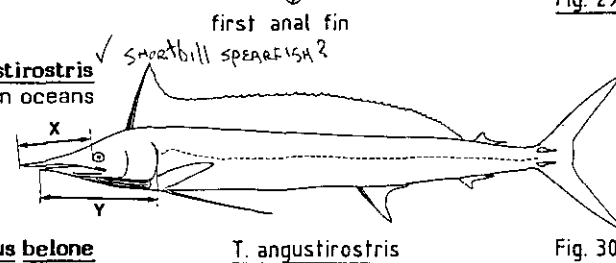


Fig. 30

- 7b. Bill moderately short, less than 18% of body length (Fig. 31) Tetrapturus belone
Mediterranean Sea

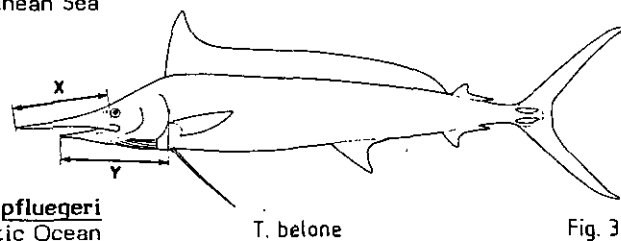


Fig. 31

- 6b. Bill long, its length (X) usually equal to, or longer than, head length (Y); pectoral fins wide and long, more than 18% of body length (Fig. 32) Tetrapturus pfluegeri
Atlantic Ocean

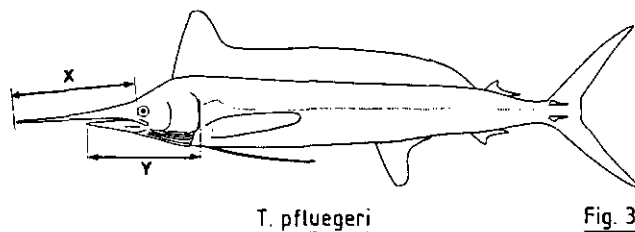


Fig. 32

5b. Anterior lobe of first dorsal fin somewhat higher than remainder of the fin, the height decreasing gradually backward (Figs 34,35,36); anus situated near origin of first anal fin (Fig.33), the distance between them (X) smaller than height of first anal fin (Y)

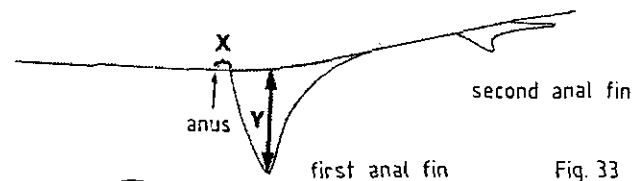


Fig. 33

8a. Tip of first dorsal fin, pectoral fins and first anal fin rounded (Figs 34,35)

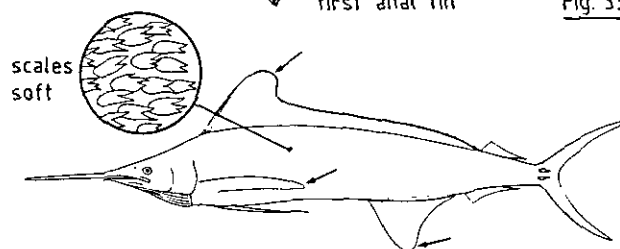


Fig. 34

9a. First dorsal fin unspotted; scales on midbody soft and rounded (Fig.34).... Tetrapturus georgei
Eastern Atlantic and Mediterranean

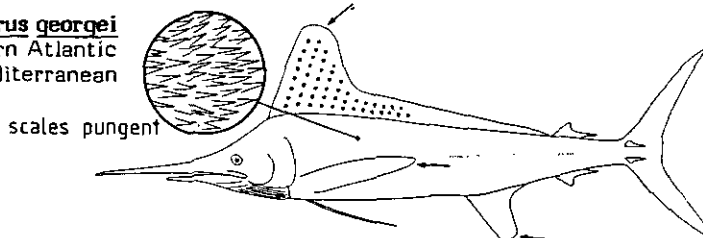


Fig. 35

9b. First dorsal fin spotted; scales on midbody pungent, each scale elongate with 1 or 2 spines (Fig. 35) Tetrapturus albidus
Atlantic Ocean

8b. Tip of first dorsal fin, pectoral fins and first anal fin pointed (Fig.36) Tetrapturus audax
Pacific and Indian oceans

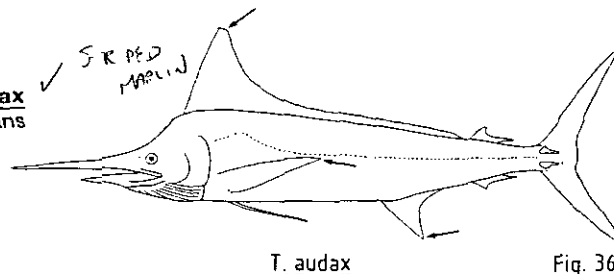


Fig. 36

4b. Height of anterior lobe of first dorsal fin (X) lower than body depth (Y); nape highly elevated (Fig.37); body not compressed laterally; vertebrae 11+13=24

10a. Pectoral fins can be folded back against sides of body

11a. Lateral line system with simple loops (Fig.38) Makaira mazara
Pacific and Indian oceans

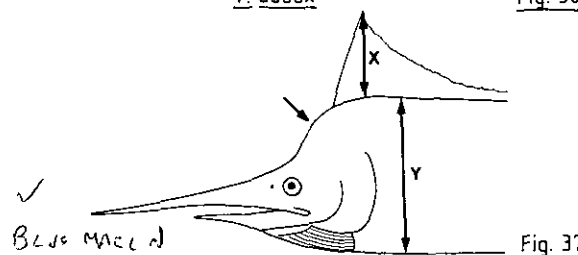


Fig. 37

11b. Lateral line system reticulated (Fig.39) Makaira nigricans
Atlantic Ocean

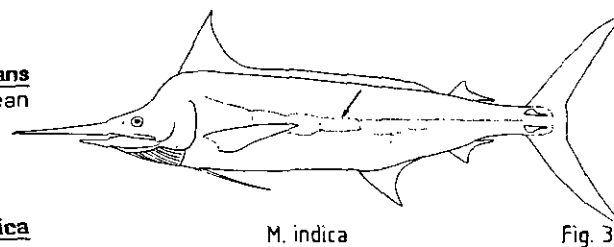


Fig. 38

10b. Pectoral fins rigid, cannot be folded back against sides of body (Fig.40) Makaira indica
Pacific and Indian oceans

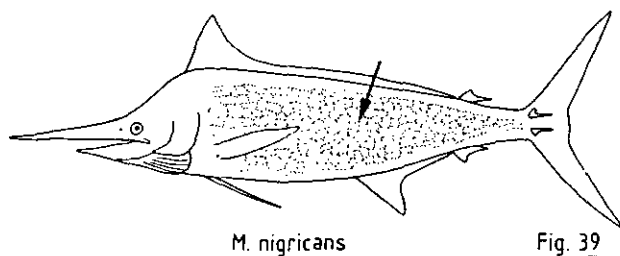


Fig. 39

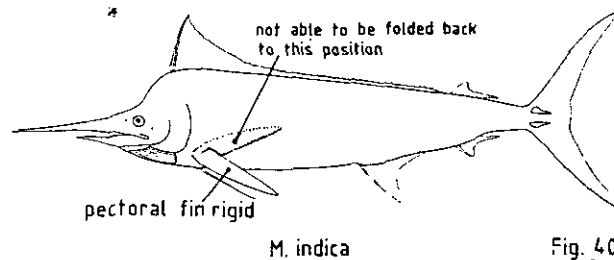
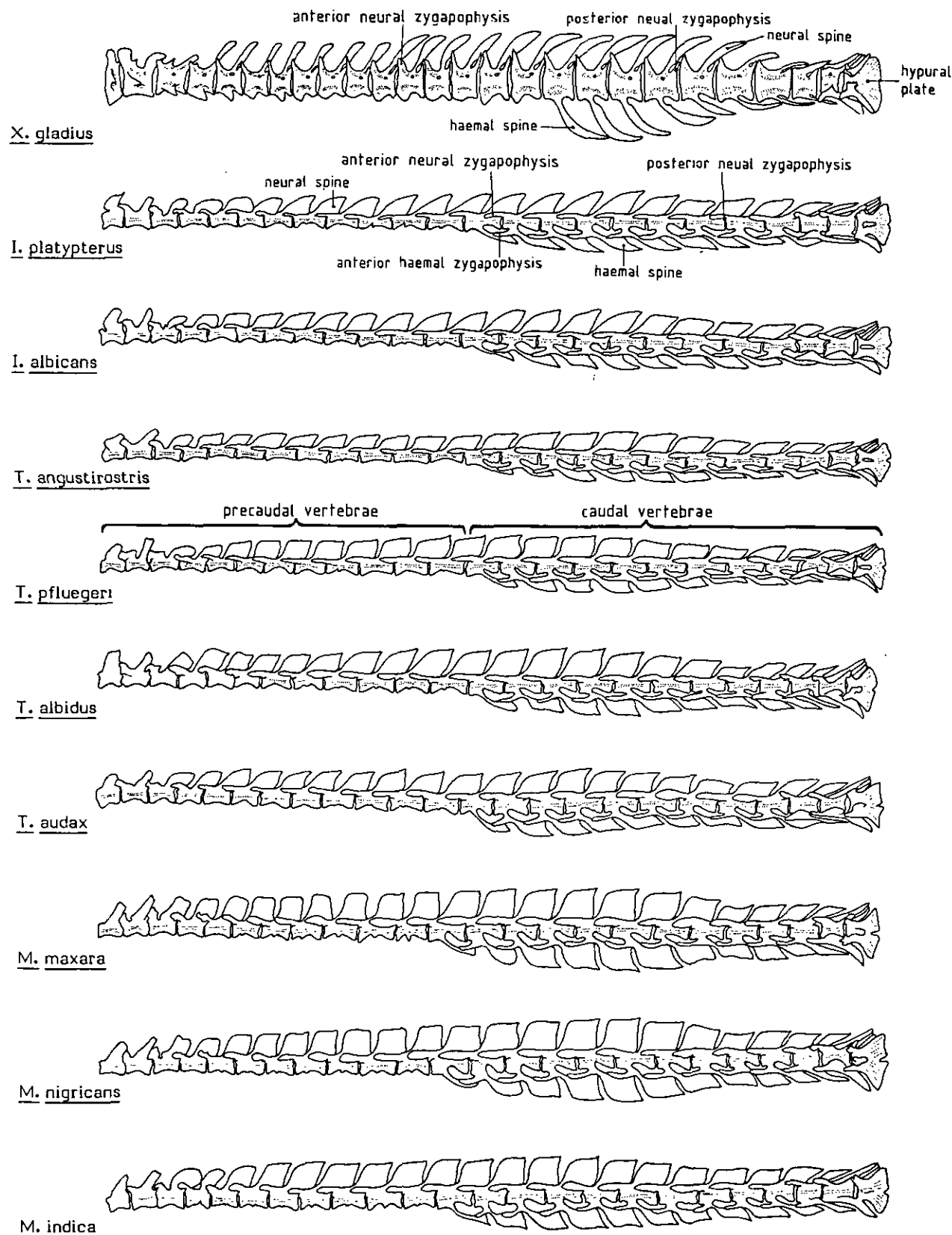


Fig. 40

2.2 Additional Aids to Identification of Genera and Species

The shape of vertebrae of billfishes shows characteristic variations by species or genus and may be used as an additional aid to species identification, especially in the case of specimens that are damaged or cut (Fig.41)



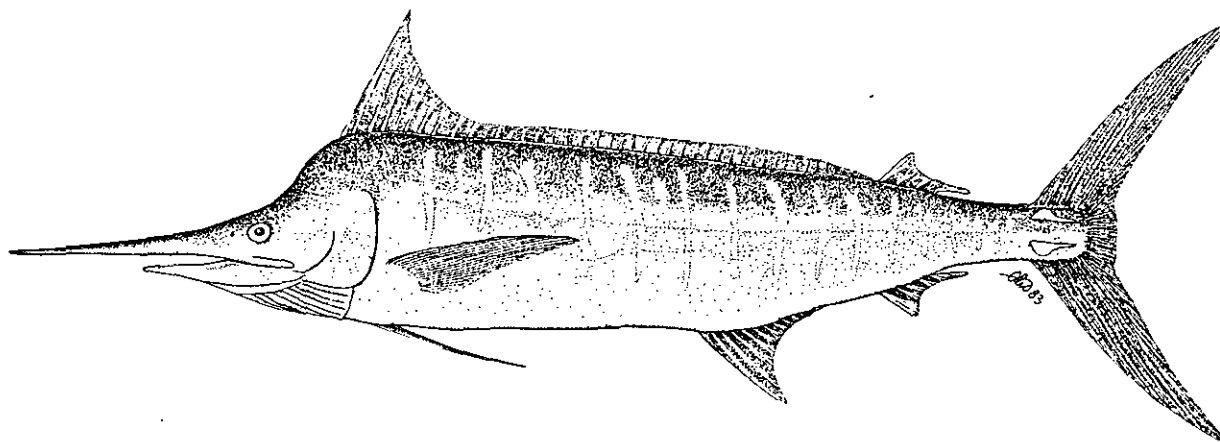
Vertebrae of billfishes (modified after Nakamura, 1983, Fig.10)

Fig.41

Tetrapturus mazara Jordan & Snyder, 1901, *J.Coll.Sci.Imp.Univ.Tokyo*, 15(2):305 (Japan).

Synonymy: *Makaira mazara* Jordan & Evermann, 1926; *Makaira ampla mazara*-LaMonte, 1941; *Makaira nigricans*-Fowler, 1944 (many authors erroneously use the name *Makaira nigricans* for this species); *Eumakaira nigra* Hirasaka & Nakamura, 1947; *Makaira nigricans mazara*-Rosa, 1950; *Istiompax howardi* Whitley, 1954; *Istiompax mazara*-Whitley, 1968; *Makaira nigra*-Abe, 1957; *Makaira* (*Makaira*) *nigricans*-Robins & de Sylva, 1961.

FAO Names: En - Indo-Pacific blue marlin; Fr - Makaire bleu de l'Indo-Pacifique; Sp - Aguja azul del Indo-Pacífico

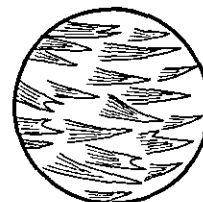


Field Marks: Body not very compressed; nape highly elevated; height of anterior lobe of first dorsal fin less than greatest body depth; lateral line system with simple loops.

Diagnostic Features: Body not strongly compressed. Bill long, extremely stout and round in cross section; nape conspicuously elevated; right and left branchiostegal membranes completely united to each other, but free from isthmus; no gillrakers; both jaws and palatines (roof of mouth) with small, file-like teeth. Two dorsal fins, the first with 40 to 45 rays, lower than body depth throughout its length, with a pointed anterior lobe and a long base, originating above the posterior margin of preopercle and ending close to the second dorsal fin origin; second dorsal fin with 6 or 7 rays, its position slightly backward with respect to that of second anal fin; two anal fins, the first with 12 to 17 rays and the second with 6 or 7 rays; pectoral fins long and narrow, adpressible to sides of body, with 20 to 23 rays; pelvic fins shorter than the pectorals, with a poorly developed membrane and depressible into deep ventral grooves. Caudal peduncle fairly compressed (laterally) and slightly depressed (dorsoventrally), with strong double keels on each side and a shallow notch on both the dorsal and ventral surfaces; anus situated near first anal fin origin. Lateral line single, following a single loop pattern, obvious in juveniles and immature fish, but obscure in adults, as it becomes progressively imbedded in the skin with growth (however, the line becomes always clearly visible when the epidermis is removed). Body densely covered with elongate, thick, bony scales, each with usually 1 or 2, sometimes with 3 posterior points. Vertebrae 24 (11 precaudal and 13 caudal). Colour: body blue-black dorsally and silvery white ventrally, with about 15 rows of

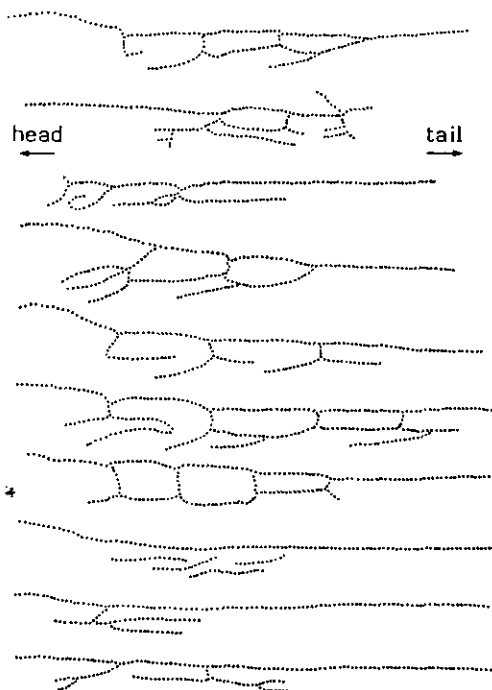


ca. 17 cm. body length



ca. 170 cm. body length

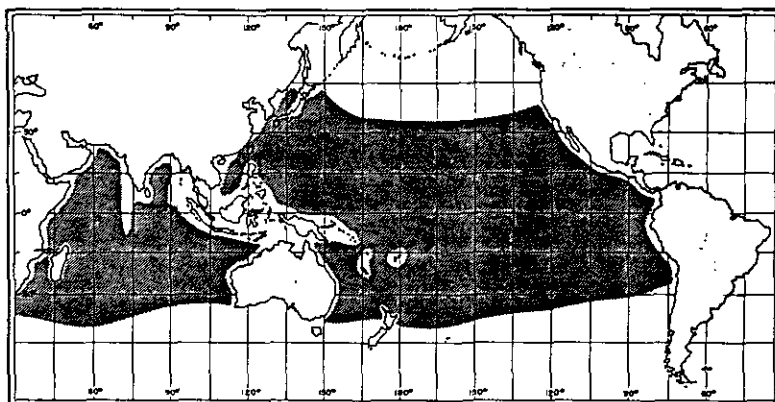
Schematic drawings of scales (not same size)



Lateral line systems of left side in size growth (schematic)

pale, cobalt-coloured stripes, each consisting of round dots and/or narrow bars (these stripes may not always be visible, especially in long-preserved specimens). First dorsal fin blackish or dark blue, other fins blackish brown, sometimes tinged with dark blue; bases of first and second anal fins tinged with silvery white.

Geographical Distribution: The Indo-Pacific blue marlin is found primarily in the tropical and subtropical waters of the Pacific and Indian oceans. It is the most tropical billfish species and is frequent in equatorial waters. Its latitudinal range, based on data from the commercial longline fishery, extends to about 45°N in the western North Pacific Ocean, 35°N in the eastern North Pacific, 35°S in the western South Pacific, 25°S in the eastern South Pacific, 40 to 45°S in the southwestern Indian Ocean and 35°S in the southeastern Indian Ocean.



Habitat and Biology: This is an epipelagic and oceanic species mostly confined to the waters on the warmer-side of the 24°C surface isotherm and known to effect seasonal north-south migrations. Pacific blue marlins are not usually seen close to land masses or islands, unless there is a deep drop-off of the shelf (900 to 1 800 m as in the waters off Kailua-Kona, Hawaii Island).

The monthly distribution of catches by Japanese longliners shows two main seasonal concentrations of *M. mazara*: one from December through March in the western and central South Pacific between 8° and 26°S, and the other from May through October in the western and central North Pacific between 2° and 24°N. In the remaining two months (April and November) the fish tend to concentrate in the equatorial Pacific between 10°N and 10°S. This species becomes less abundant toward the eastern Pacific; in the Indian Ocean, it is known to be relatively abundant around Sri Lanka and Mauritius; off the east coast of Africa, it is apparently abundant between the equator and 13°S during the southeast monsoon period (from April to October).

In Hawaiian waters, an ecological interaction is known between *M. mazara* and the striped marlin, *Tetrapturus audax*, with the two species responding in different, respectively exclusive ways, to certain environmental factors such as temperature or food.

Of 170 individuals of *M. mazara* tagged from 1963 through 1970 in the Pacific Ocean, no recoveries were made up to 1972. Five specimens were tagged with ultrasonic transmitters and tracked off Hawaii in 1971 and 1972. A fish of 270 kg was successfully tagged and tracked on 14 and 15 July 1971, 3.1 miles west of Keauhou, Hawaii Island (Yuen, Dizon & Uchiyama, 1974). The tag was inserted on 14 July at 09:35 hours and the fish was tracked by the R.V. CHARLES H. GILBERT until 08.00 hours of the next morning. A temperature-sensitive tag was used on this occasion for the purpose of obtaining information on depth. During the tracking period, the fish moved to about 25 miles north of the point of release on an erratic course cruising between the 183 m and 1 830 m (100 and 1 000 fathom) isobaths. The calculated speed of the fish ranged from 0.6 to 4.4 knots (0.09 to 0.62 body length/sec) with an average of 1.6 knots (0.23 body length/sec). Swimming depth varied from the surface to 73 m, but the fish remained mostly within the upper 37 m.

Larvae of *M. mazara* have been extensively collected in the tropical and subtropical waters of the western and central Pacific Ocean, and south of the Maldiva Islands, around the Mascarene Islands, and off the south coasts of Java and Sumatra in the Indian Ocean. Ripe eggs in the ovary are transparent with a yellow oil globule, and measure about 0.8 to 0.9 mm in diameter.

This species is believed by commercial fishermen to form small-scale schools consisting of at most ten individuals. Larger fish tend to swim solitary.

M. mazara is known to feed in and near surface waters, but sometimes takes food in relatively deep waters as is suggested by the finding of the deep-dwelling squirrel fish (*Holocentrus laeoguttatus*) in the stomachs of this species off Hawaii. The feeding behaviour has been observed by a fishery biologist off Baja California: after a fish of about 3 m body length had found a school of squids (*Dosidicus gigas* measuring about 40 cm mantle length) that was gathering under the night-light of a squid-fishing boat, it approached the school at almost full speed with its fins completely held back in the grooves, then suddenly hit the squids with its bill, subsequently nudging the stunned prey and eating it head first. This species has also been observed to swallow big tunas like skipjack (*Katsuwonus pelamis*), yellowfin tuna (*Thunnus albacares*) and bigeye tuna (*Thunnus obesus*) head first, and the fishes found in stomachs of *M. mazara* often showed deep slashes on their bodies, presumably caused by the bill of the marlin. These observations show that this species seems to use its bill quite often for feeding.

Stomachs of M. mazara contained mostly squids (Philippine Sea), and tuna-like fishes (off New Zealand and in the central Pacific). In Hawaiian waters, tuna-like fishes make up more than 85% in volume of the Indo-Pacific blue marlin's diet. A large individual caught off Hawaii had a 29 kg bigeye tuna in its stomach and its weight, including the bigeye, was 340 kg. In the eastern North Pacific, M. mazara has been shown (from the results of Japanese longline research cruises) to feed primarily on squids and fishes, in particular Bramidae, Carangidae, Gempylidae, Auxis spp., Xiphias gladius, etc.

Dr Radtke estimated the age of this species based on otolith readings (Pacific Gamefish Research News, 1982) as follows: (1) Males: 52.1 kg=6 years; 68.3 to 71.2 kg=7 to 8 years; 82 kg=9 years; 96.9 to 114.2 kg=11 to 12 years; (2) Females: 135.4 to 147.4 kg=8 years; 209.2 to 228.8 kg=13 to 15 years; 286.3 kg=16 years, 336.5 kg=17 years.

Large pelagic sharks like Isurus, Prionace, Lamna and Carcharhinus, as well as the killer whale (Orcinus orca) and related species have often been observed to attack tunas and billfishes (including this species) hooked on longlines. The author believes that such attacks are highly improbable under natural conditions.

Size: M. mazara attains sizes over 906 kg (2 000 lb) in commercial longline fisheries and to about 820 kg in sportsfishing activities. The heaviest record in sportsfishing (unofficial data, since more than one person was on the fishing rod) is the 818 kg (1 805 lb) "Choys monster" caught by Captain Cornelius Choy and his party off Waikiki, Hawaii; the second-largest is a specimen of 447 cm total length, 523 kg (1 153 lb) weight, and 185 cm of girth caught at Ritidian Point in Guam (this is the all tackle angling record). The heaviest record listed in "World Record Game Fishes, 1982" published by the International Game Fish Association is a fish of 498.95 kg (1 100 lb) weight, 420.4 cm total length, and 200 cm girth width from Le Morne, Mauritius. The size range of M. mazara caught by commercial longliners averages approximately 200 to 285 cm body length in Pacific equatorial waters and 215 to 300 cm body length in the Indian Ocean.

In the Pacific, size at first maturity of males is thought to range from 130 to 140 cm eye-fork length (86.8 to 87.8% of body length). Females attain larger sizes than males; around the Bonin-Islands, fish over 200 cm eye-fork length are all females; around Taiwan Island males attain less than 120 kg weight, while females grow to over 300 kg.

Interest to Fisheries: Catches of M. mazara have been reported by about 10 countries from seven FAO Fishing Areas (51, 57, 61, 71, 77, 81 and 87). The major fishing nations in the period from 1978 to 1982 were Japan and the Republic of Korea. The total world catch was 18 193 t in 1978, 18 654 t in 1979, 21 109 t in 1980, 21 413 t in 1981 and 20 727 t in 1982. Only 8.2% (1 761 t) of the 1981 catch came from the Indian Ocean, while 91.8% (19 652 t) were taken in the Pacific Ocean, particularly in Fishing Area 61, northwest Pacific (7 543 t), by Japanese and Chinese (Taiwan Province) vessels (about equal shares); in Fishing Area 71, western central Pacific (6 048 t) by Japan, Malaysia, the Philippines and the Republic of Korea; and in Fishing Area 77, eastern central Pacific (4 979 t) by Japan and the Republic of Korea. In 1982, 8.3% of the total catch were taken in the Indian Ocean, while 91.7% came from the Pacific Ocean, particularly from Fishing Areas 61, 71 and 77 (FAO, 1984).

The gear most commonly used for fishing M. mazara is the Japanese type of longline and its derivatives, but this species is most often caught incidental to fisheries directed at other marlins (M. indica and Tetrapturus audax) and tunas (Thunnus thynnus, Thunnus obesus and Thunnus albacares). Most Japanese tuna longline vessels range in size from 240 to 340 GRT. Recently, many of them have been equipped with freezing facilities capable of preserving the fish in excellent condition at very low temperatures, between -40° and -50°C or at even lower temperatures in the most modern vessels. M. mazara is also taken incidentally by harpooning boats aiming at Makaira indica, Tetrapturus audax or Xiphias gladius around southern Japan and Taiwan Island.

The quality of the flesh is excellent for sashimi (sliced raw fresh flesh with soy-sauce and horse radish). Most of it is marketed frozen.

Local Names: AUSTRALIA: Blue marlin; CHILE: Pez zuncho; CHINA: Lan fu yii; JAPAN: Aburakajiki, Genba, Katokui, Katsuokui, Kudamaki, Kuro, Kuroka, Kurokajiki, Kurokawa, Kurokawakajiki, Kuromazaara, Mazaara, Njiachi, Njiara, Tsun; MALAYSIA: Mersudji; MEXICO: Marlin azul, Marlin negro; NEW CALEDONIA: Empereur, Marlin bleu; NEW ZEALAND: Marlin, Taketonga; REPUBLIC OF KOREA: Nok-sae-chi; TAHITI: Haura; USA: Blue marlin, Cuban black marlin; USSR: Ch'joernij marlin; VIET NAM: Cá cè' den.

Literature: Nakamura, H. (1938, 1942); Royce (1957); Ueyanagi (1964); Howard & Ueyanagi (1965); Nakamura, Iwai & Matsubara (1968); Strasburg (1969, 1970); Merritt (1971); Nakamura, I. (1974, 1983); Howard & Starck (1975).

Remarks: The English name "black marlin" was often used among Japanese scientists for Makaira mazara until the mid-sixties. "Black marlin" is a direct translation of the Japanese common name, "Kurokajiki" (kuro = black, kajiki = marlin) for this species. See also "Remarks" under Makaira nigricans.

Literature : Nakamura (1937, 1938); Royce (1957); Ueyanagi (1962); Watanabe & Ueyanagi (1963); Howard & Ueyanagi (1965); Koga (1967); Merrett (1970, 1971); Howard & Starck (1975); Kikawa (1975).

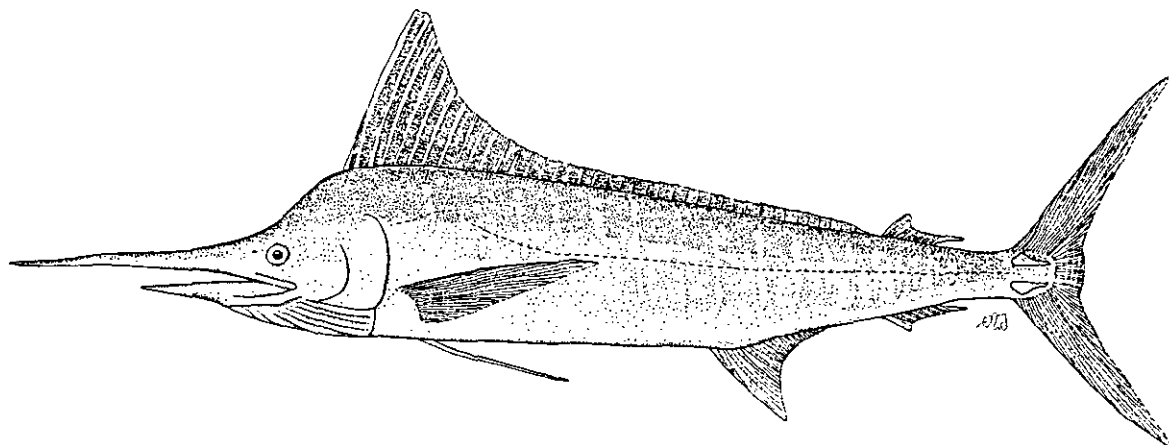
Tetrapturus audax (Philippi, 1887)

ISTIO Tetra 5

Histiophorus audax Philippi, 1887, *Anal.Univ.Chile*, 71:35-8, pl.8 (figs 2 to 3) (Iquique, Chile).

Synonymy : *Istiophorus audax*-Abbott, 1899; *Tetrapturus mitsukurii* Jordan & Snyder, 1901; *Tetrapturus ectenes* Jordan & Evermann, 1926; *Makaira grammatica* Jordan & Evermann, 1926; *Makaira holei* Jordan & Evermann, 1926; *Makaira zelandica* Jordan & Evermann, 1926; *Makaira audax*-Jordan & Evermann, 1926; *Marlina mitsukurii*-Grey, 1928; *Marlina zelandica*-Whitley, 1937; *Kajikia mitsukurii*-Hirasaka & Nakamura, 1947; *Kajikia formosana* Hiraska & Nakamura, 1947; *Tetrapturus tenuirostratus* Deraniyagala, 1951; *Tetrapturus acutirostratus* Deraniyagala, 1952; *Makaira formosana*-Matsubara, 1955; *Marlina audax*-Smith, 1956; *Tetrapturus audax*-Robins & de Sylva, 1961; *Makaira audax zelandica*-Whitley, 1962.

FAO Names : En - Striped marlin; Fr - Marlin rayé; Sp - Marlin rayado.

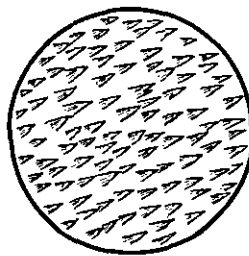


Field Marks : Anterior lobe of first dorsal fin pointed and higher than remainder of the fin, the height decreasing gradually backward; anus situated near origin of first anal fin, the distance between them smaller than half of anal fin height; tips of pectoral and first anal fins pointed.

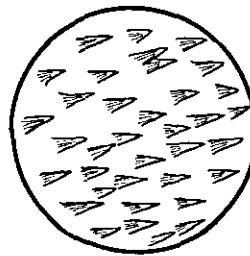
Diagnostic Features : Body elongate and fairly compressed. Bill stout and long, round in cross section; nape fairly elevated; right and left branchiostegal membranes completely united to each other, but free from isthmus; no gillrakers; both jaws and palatines (roof of mouth) with small, file-like teeth. Two dorsal fins, the first with 37 to 42 rays, usually with a pointed anterior lobe, higher than (or occasionally equal to) body depth anteriorly, the fin then abruptly decreasing in height to about the 10th dorsal fin ray and gently decreasing further backward; first dorsal fin base long, extending from above posterior margin of preopercle to just in front of second dorsal fin origin; second dorsal fin with 5 or 6 rays, its position slightly backward in respect to the second anal fin; two anal fins, the first with 13 to 18 rays, the second with 5 or 6 rays and very similar in size and shape to the second dorsal; pectoral fins long and narrow, with pointed tips, adpressible against sides of body and with 18 to 22 rays; pelvic fins slender and almost equal to, or slightly shorter than the pectorals in large specimens, and slightly longer than pectorals in smaller individuals. Caudal peduncle well compressed (laterally) and slightly depressed (dorsoventrally), with a pair of keels on each side and a shallow notch on both, the dorsal and ventral surfaces; anus situated just in front of first anal fin origin. Lateral line single and obvious, curving above base of pectoral fin and then continuing in a straight line toward the caudal fin base. Body densely covered with elongate bony scales, each with 1 or 2 posterior points. Vertebrae 24 (12 precaudal and 12 caudal). Colour: body blue-black dorsally and silvery white ventrally, with about 15 rows of cobalt-coloured stripes, each consisting of round dots and/or narrow bands. First dorsal fin dark blue; other fins usually dark brown, sometimes tinged with dark blue; bases of first and second anal fins tinged with silvery white.



ca. 12 cm.
body length



ca. 100 cm.
body length

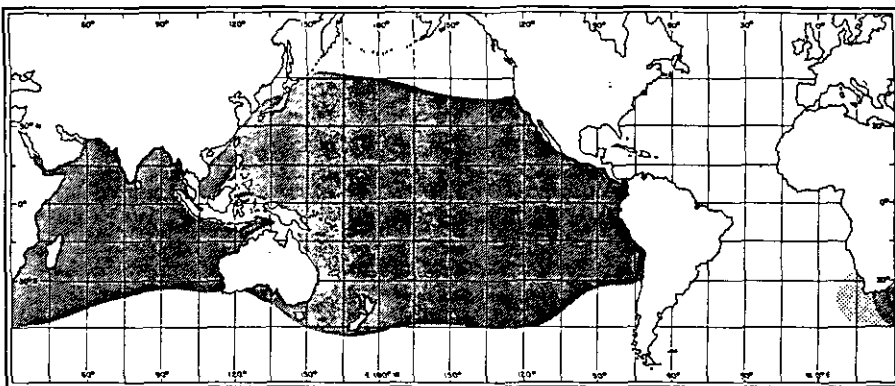


ca. 180 cm.
body length

Schematic drawings of scales (not same size)

Geographical Distribution:

T. audax occurs mainly in the tropical, subtropical and temperate waters of the Pacific and Indian oceans. Japanese long-line catch data collected over many years show that the distribution pattern of this species within the Pacific Ocean is horseshoe-shaped, with the base of the horseshoe located along the Central American coast. *T. audax* is occasionally found on the Atlantic side of the Cape of Good Hope (Talbot & Penrith, 1962) and one individual was caught off Angola, West Africa in October 1976, having probably



Area of occasional distribution, or invasion, (no spawning)

strayed from the Indian Ocean as in a few cases of *Tetrapturus angustirostris* and *Makaira indica*. The latitudinal range limits of *T. audax*, based on data from the commercial longline fishery, extend from about 45°N in the North Pacific to 30°S in the eastern South Pacific and to 45°S in the western South Pacific, as far south as 45°S in the southwestern Indian Ocean and 35°S in the southeastern Indian Ocean.

Habitat and Biology: This is an epipelagic and oceanic species, usually swimming above the thermocline. Parin (1968) included it among the holoepipelagic species which inhabit the isothermic, surface-pelagic layer of the ocean at all stages of their life cycle, and are usually confined to tropical and subtropical waters where permanent thermoclines exist, but penetrate higher latitudes in the local warm seasons. However, the striped marlin has a somewhat atypical distribution as compared to most other billfishes and tunas, and seems to prefer more temperate waters. In the Pacific, its distribution resembles that of the albacore (*Thunnus alalunga*) and the bluefin tuna (*Thunnus thynnus*), in contrast to that of the other billfishes and tunas. In the Indian Ocean, however, it is found in warmer waters. The total distributional range of this species, is generally bounded by the 20° and 25°C isotherms, at least in the western Pacific Ocean. This is the most dominant and widely distributed of all billfishes, especially in the eastern and northcentral Pacific, where it is much more abundant than in the western Pacific. In the Indian Ocean, the striped marlin is abundant in the western Arabian Sea.

Larvae of striped marlin have been recorded from the western North Pacific (west of 180° long.) between 10° to 30°N, and from the central South Pacific (west of 130°W) between 10° and 30°S. They are most abundant in the respective local early summers, with peak occurrences during May through June in the western North Pacific, and in November and December in the central South Pacific. The seasonal occurrence of mature females coincides with that of the larvae. While the distribution of larvae for the eastern Pacific (east of 120°W) is not known, mature fish are reported to occur there between 5° and 20°N, largely in May and June. Larvae have also been reported to occur in the Banda and Timor seas in January and February, in the eastern Indian Ocean in October and November between 6°N and 6°S, and in the western Indian Ocean between 10°S and 18°S in December and January. Mature females are found in March and May in the Bay of Bengal, although larval occurrence is not yet known there. The lower temperature limit in the distribution of larvae is approximately 24°C, both in the Indian and Pacific oceans. However, larval distributions in the two oceans differ in that, in the Pacific, the larvae of this species are scarcely found in equatorial waters. It has been noted that larvae of *T. audax* are not likely to appear in the Kuroshio Current area, while those of the Indo-Pacific sailfish, *Istiophorus platypterus* occur there extensively. Two juveniles of striped marlin (12.2 and 14.5 cm body length) were found in stomachs of a yellowfin tuna (*Thunnus albacares*), and of a dolphinfish (*Coryphaena hippurus*) taken by longlines on 13 January 1955 at 23°52'S/175°49'W and on 21 December 1964 at 17°5'S/67°29'E. These two occurrences coincide with larval distributions of the species in the South Pacific and Indian oceans, respectively.

The ovarian eggs of striped marlin from New Zealand average about 0.85 mm in diameter shortly before spawning. The size of ovulated eggs is presumed to exceed 1 mm in diameter, considering that the mean diameter of the eggs of the shortbill spearfish (*Tetrapturus angustirostris*) is 1.442 mm and that the eggs of the Indo-Pacific sailfish (*Istiophorus platypterus*), measure 1.304 mm in diameter.

T. audax, like the other marlins, does not form dense schools like the tunas, and the individuals are usually dispersed at considerably wide distances. Several fish, however, are often seen together, sometimes following one another, especially during the spawning season. Surfacing is apparently more common with strong wind and high waves. When wind and current are moving in the same direction, the water surface is rather smooth, but when the wind runs against the current, high waves develop and this is when striped marlin are most often seen at the surface around Taiwan Island, usually swimming in the direction of the wind. When surfaced, striped marlins usually swim very slowly, with the upper caudal fin lobe above the surface and the dorsal fin retracted and not showing, a characteristic which reportedly distinguishes them from swordfishes which are unable to depress the dorsal fin and show both the dorsal and caudal fins when surfaced. Striped marlins swim faster and are less easily approached when surfaced than the swordfish. Like other billfishes and tunas, they tend to school by size. For example, in the eastern Pacific, fish on the southern spawning grounds (forming a single size mode at 180 to 200 cm eye-fork length = 83.9 to 86.1% of body length) are larger than those on the northern spawning grounds

(two size modes, one at 140 cm and one at 180 cm). Smaller striped marlins occur in equatorial waters of the Pacific, but these small fish are absent between 5° and 16°S; in midlatitudes (15° to 30°S) of the central South Pacific, a longitudinal stratification is apparent, the larger fish (over 180 cm eye-fork length) occurring in the western Pacific; harpooned fish tend to be larger than longlined fish in the East China Sea, and the harpooned fish are also fatter at a given length.

Dolphinfishes (*Coryphaena* spp.), wahoo (*Acanthocybium solandri*) and the pelagic large sharks (*Prionace*, *Isurus*, *Lamna*, *Carcharhinus* and *Alopias*) feed on many of the same forage organisms as the striped marlin. Its closest competitors for food are possibly the other billfishes and larger tunas. The striped marlin, however, tends to feed more on epipelagic organisms and less on mesopelagic ones than the swordfish and the oceanic tunas. Food habits do not appear to vary significantly with sex or size, at least in adults. Considerable variation in species composition of the diet occurs, however, with seasons and geographic localities. *T. audax*, like other billfishes and tunas, is thought to be carnivorous and a non-selective feeder. Some of its reported major forage species by localities are: *Fistularia* sp., *Auxis* sp., squid (East Africa); *Scomberomorus saurus*, *Arripis trutta*, *Loligo* sp., *Ommastrephes sloani*, *Caranx lutescens*, *Scomber japonicus* (New Zealand); *Alepisauridae*, *Clupeidae* (Tasman Sea); *Gempylus serpens*, *Cololabis saida*, *Engraulis mordax*, *Sardinops caerulea*, *Trachurus symmetricus* (California); *Etrumeus teres*, *Fistularia* sp., *Argonauta* sp., squid (Mazatlan, Mexico); *Etrumeus teres*, *Scomber japonicus*, *Fistularia* sp., squid (Baja California, Mexico); *Auxis* spp., *Bramidae*, *Gempylidae*, squid (eastern North Pacific); *Alepisaurus* spp., squid (eastern South Pacific); squid (Peru-Chile); *Engraulis ringens*, *Trachurus symmetricus*, squid (Chile).

Predators of adults of this species are probably extremely rare or almost inexistent, the only likely candidates being some of the large pelagic sharks and the toothed whales, although there are many predators to the earlier life-stages of the striped marlin.

Size: The maximum size attained by this species exceeds 350 cm in total length and 200 kg in weight. The all tackle angling record is a fish caught off the Cavalli Islands, New Zealand, on 14 January 1977, weighing 189.37 kg (417 lb 8 oz). Other records of large specimens (over 180 kg) are the following: 183.47 kg (404 lb 8 oz), Bay of Islands, New Zealand, on 12 March 1980; 181.89 kg (401 lb), Cavalli Islands, New Zealand, 24 February 1970; 180.53 kg (398 lb), Mayor Island, New Zealand, 30 December 1974 (IGFA, 1981). All world records for both men and women recognized by IGFA are from New Zealand, except a record from Botany Bay, Sydney, on 24 October 1976 (161.93 kg=357 lb for men's 30 lb line class).

Size at first capture (longline fisheries) of *T. audax* is approximately 80 cm eye-fork length (= 83.9 to 86.1% of body length). Around Taiwan Island, size at first maturity is generally estimated between 140 cm and 160 cm eye-fork length, and the biological minimum size of males at about 137 cm eye-fork length. The maximum size in commercial fisheries is probably about 290 cm eye-fork length or 258.6 kg (570 lb). The sizes of fish taken by commercial longliners range mainly from 205 to 225 cm body length in the northern part of the western North Pacific, between 145 and 185 cm body length in the southern part of the western North Pacific, between 235 and 255 cm body length in the central North Pacific, and about 280 cm body length in the western South Pacific.

Interest to Fisheries: In the period from 1978 to 1982, catches of *T. audax* have been reported from seven FAO Fishing Areas (51, 57, 61, 71, 77, 81 and 87), mostly by Japan and the Republic of Korea. The total world catch was 15 426 t in 1978, 15 988 t in 1979, 18 429 t in 1980, 15 664 t in 1981 and 15 460 t in 1982. Only 13.6% (2 132 t) of the 1981 total catch was taken in the Indian Ocean, and 86.4% (13 532 t) in the Pacific Ocean, particularly in Fishing Area 61 (northwest Pacific) with 7 229 t predominantly by Japan, in Fishing Area 77 (eastern central Pacific), with 2 414 t predominantly by Japan, and in Fishing Area 87 (southeast Pacific) with 2 217 t by Japan and the Republic of Korea (FAO, 1983); of the 1982 catch, 12.6% (1 949 t) was taken in the Indian Ocean and 87.6% (13 511 t) in the Pacific Ocean, predominantly by Japan, China (Taiwan Province) and the Republic of Korea (FAO, 1984).

The commercial catch of *T. audax* is taken mostly by surface longlining, while harpooning may be responsible for less than 1% of the total catch in recent years. The longliners aim chiefly at tunas and marlins which are frequently swimming at depths between 100 and 150 m. Longline gear consists of a mainline, float lines, branch lines, hooks, bouys including several radio-bouys, and flags. Several hundred of these units (each unit is referred to as a "basket") are joined in a series to make up a set of longline. The longline is retrieved with a line hauler. Japanese longliners in the eastern Pacific use about 2 000 hooks (about 400 baskets) per set. Due to recent manpower problems, considerable effort has been directed toward developing labour-saving devices in longlining. The reel-type and the tub-type of longlining are two examples of this development. In the reel-type the mainline (usually wire) is continuous and reeled onto a large drum, while in the tub-type, the retrieved line is coiled into a large tub. In harpooning, the electric harpoon has been recently introduced in Japanese fisheries to speed up the killing of the fish.

The quality of the flesh is the best among billfishes for sashimi and sushi. It is marketed mostly frozen, sometimes fresh.

Local Names: AUSTRALIA: Striped marlin; CHILE: Pez aguja; CHINA: Chi zuo fo yii, Hung ju chi yii, Hung ju ting pan; JAPAN: Achinoiyo, Achinoiyu, Achinuigu, Akinoio, Akinoiyo, Amenashi, Bai, Boke, Chiruguwa, Dainanbo, Haihage, Hainouo, Haise, Mage, Maka, Makajiki, Masashi, Masasu, Naeragi, Naidonbo, Nairage, Nairagi, Nairanbo, Neeranbo, Nooragi, Nouragi, Oiragi, Oiraki, Okajiki, Sashi, Sasu, Shitore, Shiutome, Tenguazawara,

Tsukinbo, Unjiachi; KENYA: Nduaro; MEXICO: Agujón, Marlín, Marlín rayado, Pez puerco; NEW CALEDONIA: Empereur, Marlín rayé, Empereux; NEW ZEALAND: New Zealand marlin, Striped marlin; PHILIPPINES: Dugso, Lipipan, Marasugi, Spearfish; REPUBLIC OF KOREA: Cheong-sae-chi; SRI LANKA: Haura; USA: Barred marlin, Pacific striped marlin, Spearfish, Spikefish, Striped marlin, Striped swordfish; USSR: Polosatii marlin; VIET NAM: Cá cò mitsukurii.

Literature : Nakamura, H. (1938); Ueyanagi (1959, 1964); Jones & Kumaran (1964); Howard & Ueyanagi (1965); Nakamura, I. (1968); Parin (1968); Kume & Joseph (1969, 1969a); Ueyanagi & Wares (1975); and Silas & Pillai (1982).

Remarks : Honma & Kamimura (1958) and Kamimura & Honma (1958) advanced the hypothesis that North and South Pacific populations of this species, being quite separate from each other, may represent different species, based on differences in pectoral fin length, and ecology. Further study is needed on this problem.

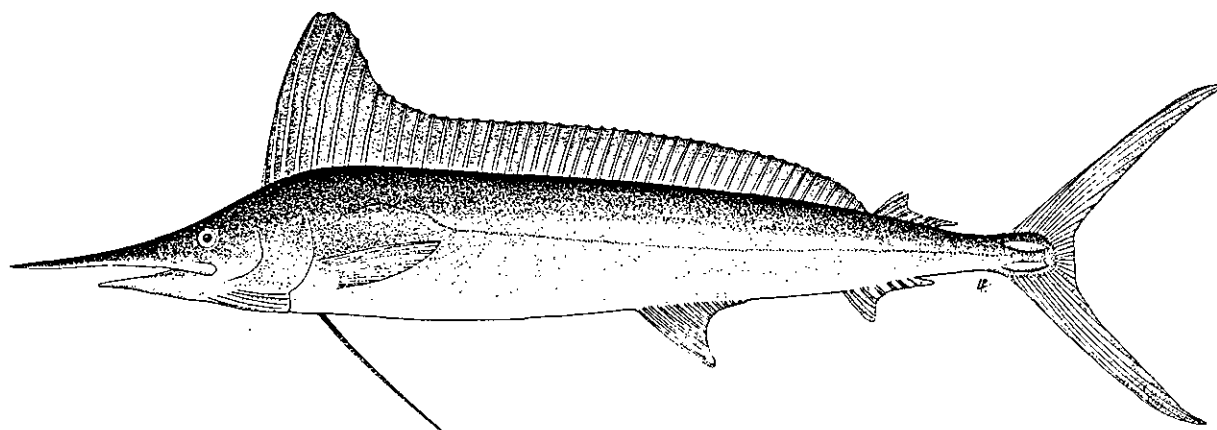
Tetrapturus belone Rafinesque, 1810

ISTIO Tetra 6

Tetrapturus belone Rafinesque, 1810, Caratteri di alcuni nuovi generi e nuove specie di animali epianche della Sicilia, con varie osservazioni sopra i messimi. Palermo, 1810, 105 pp., 20pl.(ref.p. 54-5, pl.1, fig. 1).

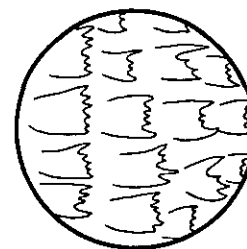
Synonymy : Skeponopodus typus Nardo, 1833; Tetrapterurus belone-Bonaparte, 1841; Tetrapterus belone-Agassiz, 1843; Tetraplurus belone-Verany, 1847; Histiophorus belone-Günther, 1860; Scheponopodus prototypus Canestrini, 1872; Histiophorus (Tetrapturus) belone-Lütken, 1876; Makaira belone-Tortonese, 1958.

FAO Names : En - Mediterranean spearfish; Fr - Marlin de la Méditerranée; Sp - Marlín del Mediterráneo.



Field Marks : Bill very short, about 18% of body length; pectoral fins narrow and short, less than 15% of body length; distance between anus and anal fin origin nearly equal to anal fin height.

Diagnostic Features : Body elongate and fairly compressed. Bill rather short and slender, round in cross section; nape almost straight; right and left branchiostegal membranes completely united to each other, but free from isthmus; no gillrakers; both jaws and palatines (roof of mouth) with small, file-like teeth. Two dorsal fins, the first with 39 to 46 rays and a rounded anterior lobe higher than body depth anteriorly, the fin then abruptly decreasing to about the 10th dorsal fin ray and keeping the same height further backward; first dorsal fin base long, extending from above posterior margin of preopercle to just in front of second dorsal fin origin; second dorsal fin with 5 to 7 rays, its position backward with respect to the second anal fin by half the length of the anal fin base; two anal fins, the first with 11 to 15 rays, the second with 6 or 7 rays and very similar in size and shape to the second dorsal; pectoral fins short (10 to 13% of body length), adpressible against sides of body, their upper margins curved, lower margins nearly straight and tips pointed, with 16 to 20 rays; pelvic fins long and slender, slightly shorter than twice the pectoral fin length and depressible into deep ventral grooves. Caudal peduncle well compressed (laterally) and slightly depressed (dorsoventrally), with strong double keels on each side and a shallow notch on both, the dorsal and ventral surfaces; anus situated far anterior to first anal fin origin. Lateral line single and obvious, its arch ending between midpoint and tip of pectoral fin. Body densely covered with elongate bony scales, each with 3 to 5 posterior points. Vertebrae 24 (12 precaudal and 12 caudal). Colour: body dark bluish grey to nearly black dorsally and silvery white ventrally; usually no blotches or marks on body or fins.



scales

Synonymy : None.

Remarks : This family includes a single species, Xiphias gladius, which is easily distinguished from the istiophorids by its flat bill, the absence of jaw teeth and scales in adults, the short-based dorsal fin which is well separated from the second dorsal in adults, the absence of pelvic fins, and the presence of a single median keel on each side of the caudal peduncle.

Xiphias Linnaeus, 1758

XIPH Xiph

Genus : Xiphias Linnaeus, 1758, Systema naturae, ed.10:248.

Type Species : Xiphias gladius Linnaeus, 1758 by monotypy.

Synonymy : Ziphius Hector, 1875 (?misspelling); Ziphius Cheeseman, 1876 (?misspelling); Phaethonichthys Nichols, 1923 (based on incomplete juvenile specimen from stomach of a red-tailed tropic bird).

Remarks : This genus is monotypic.

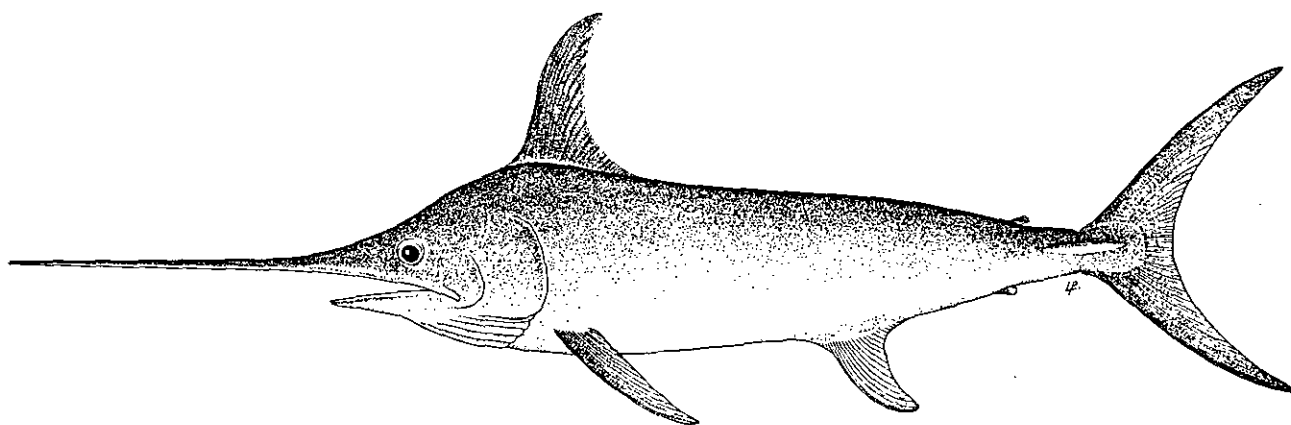
Xiphias gladius Linnaeus, 1758

XIPH Xiph 1

Xiphias Gladius Linnaeus, 1758, Syst.Nat., 10:248 (Habitat in Oceano Europae).

Synonymy : Xiphias gladius-Bloch, 1786; Xiphias imperator Bloch & Schneider, 1801; Xiphias rondeletti Leach, 1818; Phaethonichthys tuberculatus Nichols, 1923; Xiphias estara Phillips, 1932; Tetrapterus imperator-Rohlf, 1942; Xiphias thermaicus Serbetis, 1951; Xiphias gladius estara-Whitley, 1964.

FAO Names : En - Swordfish; Fr - Espadon; Sp - Pez espada



Field Marks : Bill extremely long, its cross-section flat; no teeth in jaws, in adults a large single median caudal keel on each side; no pelvic fins; body without scales.

Diagnostic Features: Body elongate and cylindrical. Upper jaw prolonged into a long bill, flat-oval in cross-section (but both jaws prolonged into long bills in immature individuals); eyes large; mouth not protrusible; fine, file-like teeth present in specimens of about 1 m (body length), disappearing with growth; gill openings wide, gill membranes united only basally and free from isthmus; no gillrakers. Two widely separate dorsal fins in adults (continuous in immature specimens), the first much larger than the second; first dorsal with 34 to 49, second dorsal with 4 to 6 rays; two separate anal fins in adults (continuous in immature specimens) the first much larger than the second; first anal with 13 or 14, second anal with 3 or 4 rays; position of second anal fin slightly more forward than that of second dorsal fin; pectoral fins falcate, a little rigid and situated low on body sides, with 16 to 18 rays; pelvic fins and pelvic girdle absent; caudal fin large and lunate. Caudal peduncle with a large keel present on each side and a deep notch on both the dorsal and ventral surfaces; anus situated near first anal fin origin. Lateral line absent in adults, but recognizable in specimens to about 1 m body length as a wavy line, disappearing with growth. Adults scaleless but scales with small spines present in specimens to about 1 m body length. Vertebrae 26 (15 or 16 precaudal and 10 or 11 caudal). Colour: back and sides of body blackish-brown, gradually fading to light-brown on ventral side; fin membrane of first dorsal fin dark blackish-brown; other fins brown or blackish-brown.

In its preadult stage, the swordfish undergoes drastic morphological changes with growth, which affect the body shape, the bill and particularly the dorsal, anal and caudal fins.

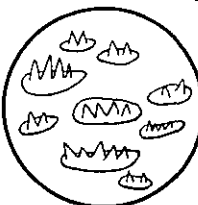
Geographical Distribution:

Cosmopolitan in tropical, temperate and sometimes cold waters of all oceans, including the Mediterranean Sea, the Sea of Marmara, the Black Sea, and the Sea of Azov. Based on data from commercial longliners' catches, the latitudinal range of this species extends from 50°N to 45°S in the western Pacific, from 50°N to 35°S in the eastern Pacific, from 25°N to 45°S in the Indian Ocean, from 50°N to 40°-45°S in the western Atlantic, and from 60°N to 45°-50°S in the eastern Atlantic.

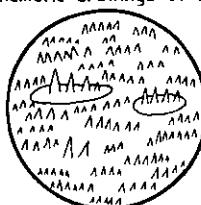
Habitat and Biology: This is an epi- and mesopelagic, oceanic species, usually found in surface waters warmer than 13°C, the optimum temperature range being 18° to 22°C in the northwestern Pacific Ocean. The swordfish has the greatest temperature tolerance among billfishes, ranging from 5° to 27°C. Based on records of forage organisms taken by this species, its depth distribution in the northwestern Pacific ranges normally from the surface to about 550 m depth. It is believed, however, to descend occasionally into waters of 5° to 10°C and to depths of at least 650 m.

The swordfish is primarily a warm-water species and, generally speaking, its migrations consist of movements toward temperate or cold waters for feeding in summer and back to warm waters in autumn for spawning and overwintering. There are two hypotheses on the migration of the swordfish in the northwestern Atlantic: (1) they migrate to the north and east along the edge of the continental shelf during summer and return to the south and west in autumn, or (2) there are different groups of swordfish migrating from deep waters toward the continental shelf in summer and moving back to deep waters in autumn.

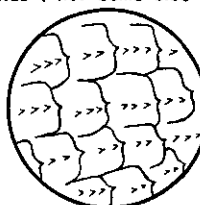
Schematic drawings of scales (not same size)



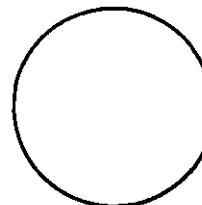
ca. 6 cm.
body length



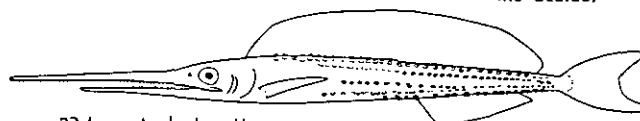
ca. 25 cm.
body length



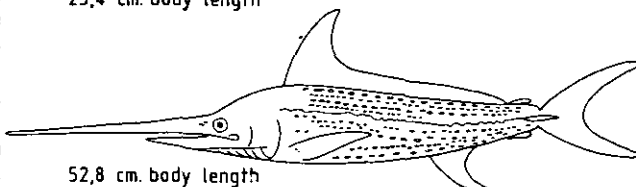
ca. 90 cm.
body length



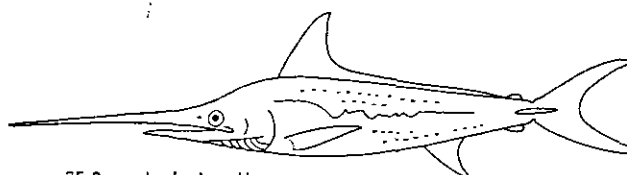
ca. 200 cm.
body length
(no scales)



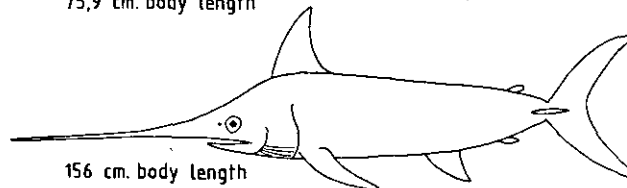
23.4 cm. body length



52.8 cm. body length

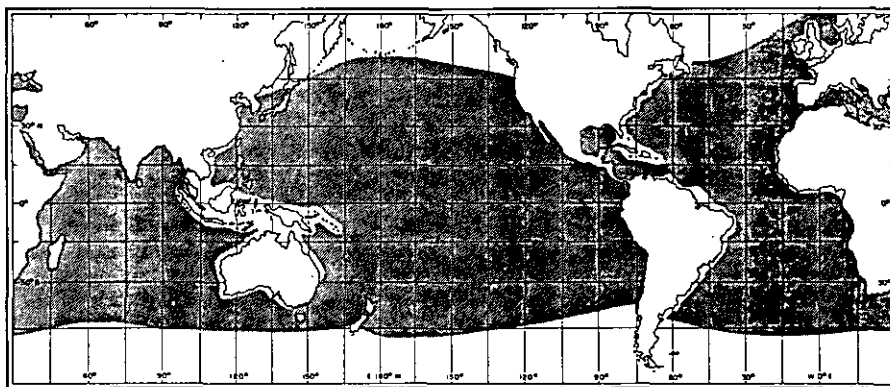


75.9 cm. body length



156 cm. body length

Body changes of swordfish with growth (schematic)



Larvae are more frequently encountered at temperatures above 24°C. In the Atlantic, spawning apparently occurs throughout the year in the Caribbean, the Gulf of Mexico, and in the waters off Florida, with the peak of the spawning season from April through September. In the Pacific Ocean, it occurs in spring and summer (March through July) in the central part, in spring (September to December) in the western South Pacific, and all the year round in equatorial Pacific waters. The best known spawning grounds of the swordfish are found in the Mediterranean Sea, off the southern part of the Italian Peninsula and Sicily, the main spawning concentrations occurring in the Straits of Messina. Adults are present on these spawning grounds in all months except January and February, and spawning is most intensive from the end of June to August, when males are often observed pursuing females. Eggs of this species have been found from June to September, and young swordfish up to 5 kg have been recorded from October to December. Large numbers of juveniles occur throughout the Mediterranean from November to March. Female gonads contain 2 to 5 million eggs. In the Atlantic Ocean swordfish spawn in the upperwater layer at depths between 0 and 75 m, at temperatures around 23°C, and salinity of 33.8 to 37.4‰.

Adult swordfish are opportunistic feeders, known to forage for their food from the surface to the bottom over a wide depth range. Over deep water, they feed primarily on pelagic fishes, including tunas (*Thunnus*), dolphinfishes (*Coryphaena*), *Alepisaurus*, *Gempylus*, flyingfishes (*Exocoetidae*), barracudas (*Sphyrnidae*) and others, and pelagic squids (*Ommastrephes*, *Loligo*, *Illex* and others), while in relatively shallow waters they take chiefly neritic pelagic fishes (mackerels, herrings, anchovies, sardines, sauries, needlefishes, etc.). Large adults often make feeding trips to the bottom where the temperatures may be 5°C to 10°C and feed on demersal fishes (hakes, *Bramidae*, trichiurids, gempylids, redfish, lanternfishes (*Myctophidae*), *Gonostomatidae*, *Sternoptychidae*, etc.). Based on stomach contents from *X. gladius*, it is most likely true that the swordfish uses its sword to kill some of its prey, particularly squids and cuttlefishes, as is shown by the slashes on the bodies of prey found in swordfish stomachs.

Size: This species reaches a maximum size of 445 cm total length and about 540 kg weight. The size range of fish taken by the commercial swordfish longliners is 120 to 190 cm body length in the northwestern Pacific; the average weight in the Mediterranean Sea ranges from 115 to 160 kg. Usually females are larger than males, and most swordfish over 140 kg are females. Adults grow over 230 kg (rarely) in the Mediterranean, up to 320 kg in the western Atlantic, and up to 537 kg in the southeastern Pacific. The all-tackle-angling record for this species is a 536.15 kg (1182 lb) fish caught off Iquique, Chile in 1953.

There is little information on biological minimum size and age and some of the data are contradictory. *X. gladius* first spawns at 5 to 6 years of age and 150 to 170 cm eye-fork length (which is 85 to 88% of body length) in the Pacific and Indian oceans (Yabe et al., 1959). Males reach sexual maturity at a length of around 100 cm and females at a length of 70 cm in the Atlantic (Ovchinnikov, 1970). However, recent research conducted on swordfish off the southeast coast of the United States indicates that males mature at a smaller size than females (at about 21 kg for males and 74 kg for females) (E. Houde, pers.comm., cited from Palko, Beardsley & Richards, 1981). Kume and Joseph (1969) regarded swordfish of less than 130 cm eye-fork length as immature.

Interest to Fisheries: There are important fisheries for *X. gladius* in the Atlantic, Indian and Pacific oceans. Catches have been reported from 14 FAO Fishing Areas (21, 27, 31, 34, 41, 47, 51, 57, 61, 67, 70, 77, 81 and 87) by about 30 countries (major fishing nations: Japan, USA, Italy, Spain, Canada, Republic of Korea, China (Taiwan Province), the Philippines and Mexico) in the period from 1978 to 1982. The world catch was 40 279 t in 1978, 37 992 t in 1971, 36 402 t in 1980, 37 726 t in 1981 and 40 321 t in 1982. Only 1 439 t of the 1981 catches were taken in the Indian Ocean, while the rest were distributed in halves between the Pacific and Atlantic oceans (including the Mediterranean Sea), particularly in Fishing Area 61 (northwestern Pacific) with 8 085 t predominantly by Japan, and secondly by China (Taiwan Province), Fishing Area 37 (Mediterranean) with 6 584 t predominantly by Italy and Spain, and Fishing Area 77 (eastern central Pacific) with 5 210 t predominantly by Mexico and Japan. More than 2 000 t were reported in 1981 from 5 other Fishing Areas, i.e., Fishing Area 21 (northwestern Atlantic) with 2 315 t predominantly by USA, Fishing Area 27 (northeastern Atlantic) with 2 163 t predominantly by Spain, Fishing Area 31 (western central Atlantic) with 2 548 t predominantly by USA, Fishing Area 34 (eastern central Atlantic) with 2 117 t by some 10 countries, and Fishing Area 71 (western central Pacific) with 2 940 t predominantly by the Philippines (FAO, 1983). Of the 1982 world catch (40 321 t), only 3.7% (1 500 t) were taken in the Indian Ocean, 43.9% (17 705 t) in the Pacific Ocean, and 52.4% (21 116 t) in the Atlantic Ocean including the Mediterranean Sea (FAO, 1984).

Catch records from the high seas tuna longline fishery indicate that swordfish are taken almost throughout the range of that fishery. For the most part, however, swordfish catches are incidental to the tuna longline fishery, except for the Japanese swordfish longlines (nocturnal longlines) called in Japanese "Mekanawa" (=swordfish longline) or "Yonawa" (=night longline) which operate in the northwestern Pacific, from Japan eastward almost to 140°W. Other important commercial fisheries directed at the swordfish are located in the western North Atlantic from the Grand and Georges Banks to the Gulf of Mexico (harpooning and longlining), in the eastern Atlantic, especially in the Gulf of Guinea and the Mediterranean Sea (longlining, harpooning and various kinds of trapping or setnetting), and in the South Atlantic off the coasts of Brazil and Uruguay (longlining).

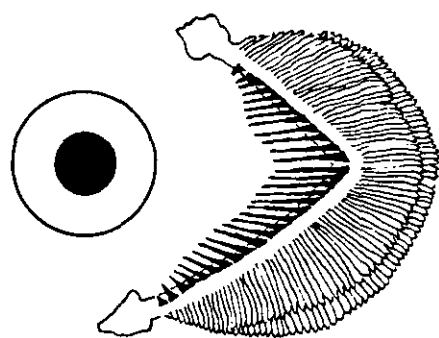
Major sportsfishing areas for trolling and drifting baited lines are located off the east coast of the USA from New York to Texas, from off the coast of California to Ecuador, Peru and northern Chile, off the east coast of Australia and around New Zealand.

The quality of the flesh is excellent for steaks, canning or "Teriyaki" (grilled meat with sugar; soy-sauce and rice wine in the Japanese way). Marketed mostly fresh or frozen.

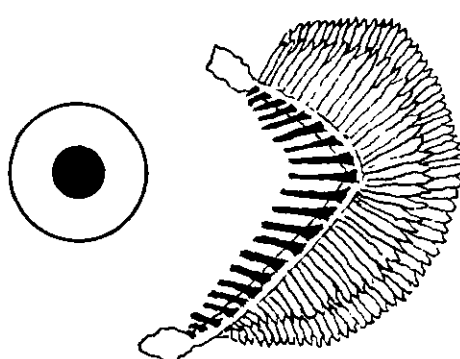
Local Names : ALGERIA: Pez espada; ARGENTINA: Pez espada; AUSTRALIA: Broadbill swordfish, Swordfish; BRAZIL: Espadarte, Peixe espada; BELGIUM: Espadon; CANADA: Broadbill swordfish, Espadon, Swordfish; CHILE: Albacora, Pez espada; CHINA: Chien-chi-yu, Ki-hi-khu, Tinmankhu; CUBA: Pez espada; DENMARK: Svaerdfisk; FRANCE: Espadon; GERMANY (FED.REP.): Schwertfisch; GREECE: Xiphias; INDIA: Kuthira-meen (Lacadive Archipelago?), Mas-hibaru; IRELAND: Luinniasc; ITALY: Pesce spada; JAPAN: Andaachi, Dakuda, Ginzasu, Goto, Hirakucha, Hyu, Io, Izasu, Kudamaki, Medara, Meka, Mekajiki, Mesara, Okizaara, Rakuda, Shiutome, Shutome, Suzu, Teppo, Tsun; MALTA: Piscispat, Pixxi spad; MEXICO: Pez espada; NETHERLANDS: Zwaardvisch; NEW ZEALAND: Broadbill; NORWAY: Sverdfisk; PERU: Pez espada; PHILIPPINES: Dugso, Doguso, Lumod, Malasagi, Malasugi, Manumbuk, Mayaspus; PORTUGAL: Agulha, Agulhao, Espada, Espadarte, Peixe agulha, Peixe espada; REPUBLIC OF KOREA: Whang-Sae-chi; ROMANIA: Reste cuspada; SOUTH AFRICA: Broadbill, Swaardvis, Swordfish; SPAIN: Aja para, Chichi spada, Emperador, Espada, Espardarte, Pez espada; SRI LANKA: Kadu kpooara; SWEDEN: Swardfisk; TUNISIA: Bou sif; UNITED KINGDOM: Swordfish; USA: Broadbill, Broadbill swordfish, Swordfish; USSR: Mechenos, Mech-ryba, Meshvenosouiye; VENEZUELA: Pez espada; VIET NAM: Ho cá mui kiem; YUGOSLAVIA: Babljan, Iglun, Igo, Jaglun, Macokljun, Sablijck.

Literature : Nakamura *et al.*, 1951; Yabe *et al.*, 1959; Tibbo, Day and Doucet (1961); Ovchinnikov, 1970; Palko, Beardsley and Richards (1981); Nakamura, 1983.

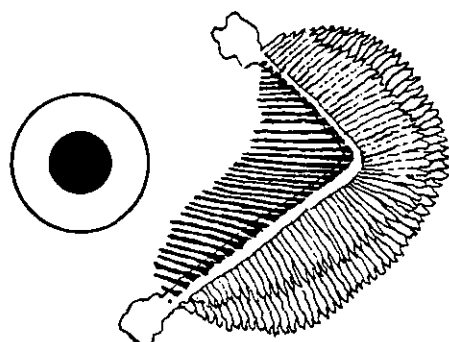
Remarks : The local name "Albacore" is used for Xiphias gladius in Chile, while "albacore" is commonly used for the longfin tuna, Thunnus alalunga in many English speaking countries. In the French speaking countries, the yellowfin tuna, Thunnus albacares is called "Albacore".



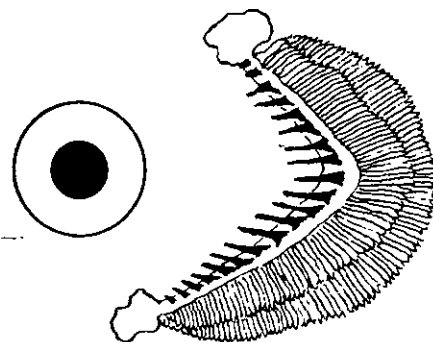
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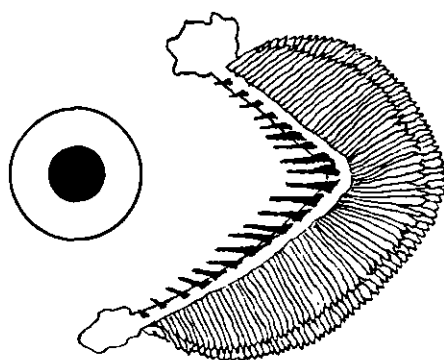
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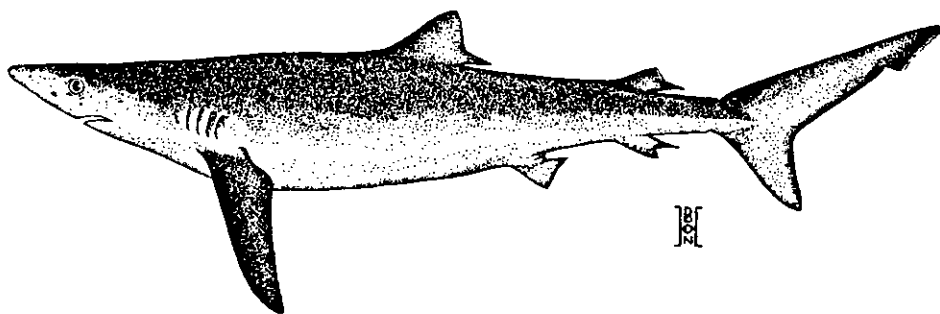


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Figure 4. — First gill arch and eye for comparison with longest gill raker length of five species of Pacific salmon.

BLUE SHARK

Prionace glauca (Linnaeus 1758)



Scientific names from the Greek roots *prion* (saw) and *akis* (point); and the Latin *glauca* (blue).

The French name is *requin bleu*.

Description Body elongate, its greatest depth at first dorsal, about 6.5 into length to precaudal notch, in undistorted specimens. Dorsal profile little arched. Head 4.5 to 5 into total length. Mouth inferior, moderate in size, directed forward. Snout conical with slightly rounded tip, long. Teeth acutely subtriangular, lateral margins strongly convex, median margins concave, edges serrate, teeth so closely placed that the bases overlap, tooth at symphysis of lower jaw sometimes reduced, in 1 to 3 functional rows. Interorbital space wide. Eyes almost circular, the mid-point above the centre of the mouth. Five gill openings, moderate in size, the middle one largest, and the last 2 over the pectoral fin. Spiracle small, close behind eye, or absent. Caudal peduncle slightly compressed, without keels on sides but tending to be rhomboid in cross section. Precaudal pits almost rectangular.¹

Fins Dorsal (2). Leading edge of first dorsal straight rounding into a concave free edge

terminating in a moderate free tip. Second dorsal similar in shape, about one-quarter area. Caudal about one-quarter of total length, subterminal notch well developed. Anal about same size as second dorsal, its free edge very concave leaving the posterior angle acutely pointed. Pectorals very long, about as long as head, narrow, and sabre-shaped. Pelvics abdominal, small, anterior margin somewhat convex, posterior margin slightly concave.

Vertebrae About 240.¹

Scales Placoid, minute, with weak ridges and scalloped edges usually overlapping. The skin not really rough to touch.

Colour Dark indigo blue on back shading through clear bright blue on sides to white below. Tips of pectorals and anal dusky. Colour lost in preservation.

Size Largest authenticated size 12 feet 7 inches (3.8 m). Reputed to reach 25 feet (7.6 m).²

Recognition Notable for the long sabrelike pectoral fin, well-developed snout, slender form, and striking colour in living specimens.

Life History Maturity is not reached at lengths of less than about 7 or 8 feet (2.1 or 2.4 m). Young are born at lengths between 18 (46 cm) and 21 inches (53 cm). Up to 30² or 60⁵ young are born at a time. The food is a wide variety of pelagic and demersal species. In the Gulf of Alaska stomachs contained salmon, lanternfishes, daggertooth, pomfret, saury, and squid.⁴ It seems to be sluggish except when feeding. It is commonly taken by salmon trollers off the west coast of Vancouver Island⁸ and used to be of common occurrence around pilchard seines. It is regarded as a nuisance by fishermen.

Distribution In the warm temperate, subtropical, and tropical oceans of the world, including the Mediterranean Sea. In mid-Pacific and inshore north to the Gulf

of Alaska and Japan,⁶ in the Atlantic north to southern Norway and Newfoundland and the Gulf of St. Lawrence. Chile south to Australia, New Zealand and South Africa, Hawaii, and Brazil. In British Columbia common off the west coast of Vancouver Island in summer, and off the Queen Charlotte Islands.^{1,3} Experimental fishing indicated northward movement of the population from May to September and catches were made only at water temperatures between 11 and 17 C.⁵

References 1 Bigelow and Schroeder 1948; 2 Clemens and Wilby 1961; 3 Fowler 1941; 4 LeBrasseur 1964b; 5 Neave and Hanavan 1960; 6 Okada 1955; 7 Springer and Garrick 1964; 8 Williamson 1930.

FAMILY SQUALIDAE

DOGFISH SHARKS

These sharks have no anal fin and two dorsal fins. The dorsal fins may or may not be preceded by prominent spines. There are no keels or precaudal pits on caudal peduncle. All five gill openings are anterior to the pectoral fin insertion. Dogfish and sleeper sharks.

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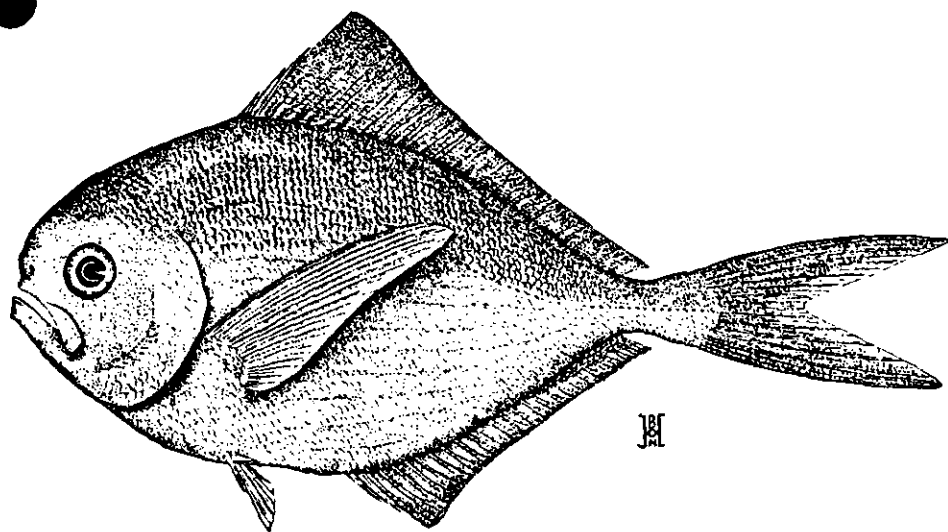
FAMILY BRAMIDAE

POMFRETS

The pomfrets are large, strongly compressed, pelagic or bathypelagic fishes. Adults have blunt snouts and are deep bodied anteriorly tapering to a shallow caudal peduncle. Dorsal and anal fins are long based, each with two or three spines at the origin. The caudal fin is lunate and the pectoral fins long and pointed. Changes in form during development complicate the assessment of species. There is one species off the coast of British Columbia; it occurs abundantly but erratically offshore and infrequently inshore. Pomfrets and breams.

(PACIFIC) POMFRET

Brama japonica. Hilgendorf 1878



Scientific names from the Latin *brama* (a European minnow with some similarity in form); and Japan.

This species was called pomfret *Brama raii* (Bloch 1791) in Clemens and Wilby 1946 and 1961.

Brama raii or *Brama brama* Bonnaterre (1785) has been regarded as inhabiting

the temperate and tropical oceans of the world.^{6,9} However, although individual adults cannot be distinguished, young of north Pacific stocks differ clearly from those taken elsewhere.^{8,10} The stock is accordingly regarded as representing a different species and the oldest acceptable name is applied.

Description Body depth about 2.2 into standard length, very compressed, deepest around midlength. Head deep, compressed, its length about 3.6 into standard length. Mouth terminal, large, directed forward and up. Upper jaw extending about to centre of pupil. Snout blunt, slightly concave. Lower jaw blunt. Jaws even. Teeth on jaws and palatines slender. Interorbital space much elevated and convex, its width about 3 into length of head. Eye rather deeper than long, its diameter about 4 into length of head. Gill membranes free from each other and isthmus. Caudal peduncle compressed, its least depth about 15 into standard length.

Fins Dorsal (I), III, 30 to 33, long, relatively high anteriorly, curving down and rather low posteriorly. Caudal deeply and finely forked. Anal II to III, 25 to 27, long and low, highest anteriorly. Pectorals about 22, falcate, longer than head, upper rays supported by cartilaginous folds. Pelvics I, 5, subthoracic, groups of long, modified scales at the outer angles of the bases.

Scales Cycloid, rather small, each with anchors up and down, precisely arranged in longitudinal rows on body, on bases of fins, and all over head. Lateral line canal forming an arch on anterior two-thirds of body and then straight along midside, 80 to 84 scales in its length.

Colour Steel gray above, silvery below with brighter bands along scale rows. Dusky to black on snout and all fins except pelvics. Orange streaks on operculum.

Size Length to 4 feet (122 cm),³ largest seen 19 inches (48 cm), probably reaches 3 feet (91 cm).

Recognition Recognizable by the compressed body, long falcate pectoral fins, large tail, and blunt head.

Life History Fishing experiments show that the area of availability to surface gillnets moves northward with the advance of the season from below latitude 50° N in early summer to the Gulf of Alaska generally in late summer,^{8,12,13} and that availability is strongly related to water temperature.^{7,11} Inshore and perhaps elsewhere the species appears and disappears erratically.¹⁴ In the north Atlantic also pomfret are only seasonally abundant, occurrence is erratic, and availability is related to water temperature.^{2,11,16} Squid, fish, and crustaceans have been found in the food.

Distribution At least as far south as Guadalupe Island,⁵ southern California, Oregon, Washington,¹⁵ Gulf of Alaska,^{17,18} Aleutian Islands,¹⁹ but not common in Bering Sea.⁸ Kamchatka, Pacific coast of Japan, and tropical mid-Pacific.⁶ Occasionally abundant in British Columbia,^{4,14} and sometimes taken inshore.¹

Utilization Reported to be a good food fish but not so far found consistently enough to provide a basis for an industry.

References 1 Anon 1939; 2 Clark 1928; 3 Clemens and Wilby 1961; 4 Cowan 1938; 5 Fitch 1950; 6 Grinols 1965a; 7 Hanavan and Tanonaka 1959; 8 Hitz and French 1965; 9 Leim and Scott 1966; 10 Mead personal communication; 11 Mead and Haedrich 1965; 12 Neave and Hanavan 1960; 13 Pinckard 1957; 14 Pritchard 1930b; 15 Schultz and DeLacy 1936; 16 Stephen 1928; 17 Van Cleve and Thompson 1938; 18, 19 Wilimovsky 1954, 1964.

JAPAN - ITS LAND & PEOPLE

Geography
Climate
Population
Politics
Education System
Religion

Geography

Japan is an arc of four main islands lying east of the Asian continent — the northernmost island of Hokkaido (83,500 sq. km./32,300 sq. mi.); Honshu or the Mainland (230,800 sq. km./89,100 sq. mi.); Shikoku, the smallest of the four (18,800 sq. km./7,300 sq. mi.); and the southernmost island of Kyushu (42,000 sq. km./16,200 sq. mi.). The beautiful subtropical island of Okinawa (2,400 sq. km./900 sq. mi.) is situated some 600 km. (380 miles) southwest of Kyushu.

There are also some 3,000 minor islands in the archipelago.

In total land area, Japan is almost as large as the state of California but somewhat smaller than Sweden.

Four-fifths of Japan's land area is mountains; a chain running through each of the main islands. Japan's highest mountain is world-famous Mt. Fuji (3,776 m./12,385 ft.).

Since only one-fifth of the entire land is flat, many of the hills and mountains you will see are cultivated all the way to the top.

Situated in the volcanic zone of the Pacific, Japan has many hot-spring resorts as well as active volcanoes. Japanese scenery is uniquely beautiful and graceful, with a quality found nowhere else.

Climate

The climate in Japan varies widely because the island chain lies almost directly north to south.

Japan has a relatively higher humidity level and a heavier rainfall in the summer than Europe. Conversely, it has lower humidity in winter. But generally the weather is mild and there are four clear-cut seasons, each with its own distinctive scenery.

Spring is the most popular season with tourists because overseas visitors are attracted by Japan's cherry blossoms and other lovely flowers. The first cherry blossoms come out as early as March in Kyushu and may be seen in northern Japan as late as May.

Summer is a season of festivals and the whole country reflects its joyous mood. Though the weather can be hot and humid, all Western-style hotels in Japan are fully air-conditioned, as are the main transportation systems. White sand beaches abound along the coast of Japan and there are many fine mountain resorts where summer can be enjoyed to the fullest within easy and quick access of urban areas.

Autumn is perhaps the most colorful of all the seasons. This is when the trees are transformed into gold and flaming red, and parks

and gardens are brightened by lovely chrysanthemums. It is harvest time too, with plenty of fresh fruits and vegetables in the markets.

Winter is not as severe in Japan as it is in Europe or the East Coast of the United States. The weather is, in fact, rather mild and dry. It rarely snows or rains in the Tokyo area, but in the northern mountainous provinces snow is plentiful and there are many good ski resorts with comfortable accommodations and excellent facilities. And your favorite winter sport is only hours by train away from Tokyo.

Mean Temperatures (Centigrade)

Area	Spring			Summer			Autumn			Winter		
	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.
Tokyo	7.9 (46.2)	13.5 (56.3)	18.0 (64.4)	21.3 (70.3)	25.7 (77.4)	28.7 (83.7)	23.0 (73.4)	18.9 (66.0)	11.7 (53.1)	6.6 (43.9)	4.1 (39.4)	4.6 (40.3)
Kyoto	7.2 (45.0)	13.1 (55.6)	18.0 (64.4)	21.8 (71.2)	26.1 (79.0)	27.3 (81.1)	23.0 (73.4)	18.7 (65.7)	11.1 (52.0)	6.0 (42.8)	3.5 (38.3)	4.0 (39.2)
Okinawa	18.1 (64.6)	20.8 (69.4)	23.8 (74.8)	26.0 (78.8)	28.2 (82.8)	27.8 (82.0)	27.1 (80.8)	24.1 (75.4)	21.4 (70.5)	18.1 (64.6)	16.0 (60.8)	16.4 (61.5)

Figures in Parentheses represent Fahrenheit.

Average Rainfall (Millimeters)

Area	Spring			Summer			Autumn			Winter		
	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.
Tokyo	98 (3.9)	122 (4.8)	146 (5.7)	182 (7.2)	140 (5.5)	153 (6.0)	182 (7.2)	203 (8.0)	86 (3.4)	56 (2.2)	48 (1.9)	65 (2.5)
Kyoto	112 (4.4)	146 (5.7)	182 (7.2)	252 (9.9)	238 (9.4)	158 (6.2)	204 (8.0)	122 (4.8)	75 (2.9)	50 (2.0)	58 (2.3)	64 (2.5)
Okinawa	154 (6.0)	142 (5.6)	304 (12.0)	320 (12.6)	134 (5.3)	253 (10.0)	152 (6.0)	148 (5.8)	151 (6.0)	148 (5.8)	122 (4.8)	116 (4.6)

Figures in Parentheses represent inches.

Population

About 113 million people are packed into a tiny area of 146,000 square miles, making Japan—considering that over 80% of the land is not arable—one of the most densely populated nations on earth.

Most significant is the concentration of Japan's population in the big cities, a trend that is being ac-

celerated by the nation's continuing industrialization.

Tokyo, second only to Shanghai, has a population of over 8,500,000. Osaka, the second largest Japanese city, has about 2,700,000 residents.

The population figures of the major Japanese cities as of May, 1977 were:

Tokyo proper	8,570,000
Osaka	2,740,000
Yokohama	2,660,000
Nagoya	2,080,000
Kyoto	1,460,000

Kobe	1,360,000
Sapporo	1,260,000
Kitakyushu	1,060,000
Kawasaki	1,020,000
Fukuoka	1,020,000

Politics

The post WW II Japanese Constitution created a government which resembled an American-style parliamentary procedure operating within a British-style framework.

There are two houses of parliament (Diet), the House of Representatives and the House of Councillors. The Lower House consists of 511 seats; the Upper, 252.

Each house functions in much the same way as the American Congress. The Lower House, however, elects the prime minister in the same manner as in Great Britain. And then the prime minister picks his cabinet. The prime minister runs the country, but if the Lower House passes a non-confidence vote, he must ask his entire cabinet to resign. Or he must dissolve the Lower House within ten days and call for new elections.

At present, the Liberal-Democratic Party is the strongest. The Socialist Party, which enjoys strong labor support, is second. The Communist Party, Komeito Party and Democratic-Socialist Party are also represented.

Education System

After WW II, the Ministry of Education announced a new educational policy which purged all military influence from Japan's educational system, thus establishing a peace-loving Japan through a new type of education.

The 6-3-3-4 school year system was established in 1947. It consists of six years of primary school (compulsory), three years of middle school (compulsory), three years of high school and four-year colleges and universities. (an additional four years are required for advanced degrees.) There are also two-year junior colleges, plus five-year technical institutes for middle school graduates.

As of June 1978, Japan has 24,777 primary schools; 10,723 middle schools; 5,028 high schools; 431 colleges and universities; 515 junior colleges; and 65 five-year technical institutes.

The school year starts in April, with vacations of about a month in July and August, and two weeks in December and January, and again in March and April.

In addition to regular lessons at school, there are a few extracurricular subjects such as the abacus, calligraphy, and English conversation. Girls usually study cooking, sewing, calligraphy, dancing (either Western or Japanese), flower arranging, tea ceremony, etc., in order to become cultured and practical wives.

Religion

There are two principal religions in Japan — Shintoism and Buddhism. Buddhism has about 55 million adherents and Shinto, 70 million.

In fact, most Japanese are both Buddhists and Shintoists. They are married in a Shinto ceremony but are usually buried with Buddhist rites. A man may have his new house "blessed" by a Shinto priest and then go to the Buddhist temple to pray for the money to pay for it.

This duality of religious belief is quite harmonious and works out rather well in that Shintoism places emphasis on enjoying the natural life here and now, while Buddhism stresses the life after death and the necessity of working toward a place in heaven.

Shintoism

Shintoism is combination of nature worship and ancestor worship. It has no known founder, no fixed doctrine and no scripture.

Since research into Shinto origins was frowned upon until after WW II, there are still disputes on that subject. It is a polytheistic religion and its divinities are called *kami*. *Kami* vary in nature from personified natural phenomena to deified persons.

Buddhism

Buddhism came to Japan in the 6th century after having spread from India through China. The principal doctrine taught by

Gautama Buddha is that life is to carry burdens which are caused by the worldly desires of man. A believer must always be careful of his or her views, intentions, speech, actions, and means of livelihood if he is to achieve *Nirvana*.

There are nearly 200 Buddhist sects in Japan of six fundamentally different groups. Zen Buddhism, the sect probably most familiar to westerners, was introduced from China in the 12th century. It attaches importance to austere training, manual labor and "zazen," (religious meditation).

Christianity

Christianity is the third largest religion in Japan. It was first introduced into Japan in 1549 when Francis Xavier, accompanied by two Spanish Jesuits, landed at Kagoshima. It was prohibited on point of death by the Tokugawa Shogunate for about 250 years. Today, there are some 873,200 Christians in Japan and about 6,000 churches.

SOME THINGS JAPANESE

Ibusuki

Located at the southern tip of the Satsuma Peninsula, Ibusuki is noted for its tobacco and its hot springs. Most of the spas lie along a 10-kilometer beach. Similar to Bepu Spa, Surigahama, one of the Ibusuki hot springs, specializes in "sunamushi" hot-sand baths. These baths are efficacious to external injuries, digestive trouble, rheumatism, neuralgia and many other ailments.

Also located close at hand is Mt. Kaimon often called Satsuma-Fuji; a caldera lake, Ikeda; and beautiful cape, Nagasakibana.

OKINAWA

Okinawa consists of more than 60 islands, large and small, and is southernmost in the Japanese archipelago, lying at approximately the same latitude as Miami, Florida, U.S.A. These subtropical islands are one of the few places in Japan where "naivete" remains. Many call Okinawa the "hidden jewel of Japan." Cobalt blue sea, emerald sky, blossoming flowers, and boundless natural beauty fill the land year round.

As a result of its subtropical geographic location and historical relationship with China and Japan, Okinawa has many unique products. For instance, "Bingata" cloth, ceramics, lacquerware, black pearls, coral crafts, tortoiseshell articles, and shell leis.

Transportation to Okinawa is mainly by air although some ocean liners call at the island. Domestic flights connect Okinawa with Tokyo, Osaka, Fukuoka, Kagoshima, Nagoya and Kumamoto.

The world's first ocean exposition, EXPO '75, was held on the Motobu Peninsula in Okinawa.

Flower Arranging
Tea Ceremony
Japanese Gardens
Kimono
Bridal Costume
Kabuki
Noh Drama
Judo
Karate
Sumo
Ryokan-Japanese Inns

FLOWER ARRANGING (IKEBANA)

Ikebana, the art of flower arranging, is one of unique cultural heritages you will encounter in Japan. Born in the Muromachi period (1338-1573) when the tea ceremony began to take hold among highranking *samurai*, its simplicity is of necessity, as there was only a small space in the tiny teahouse for flowers.

Today, there are three or four thousand different Ikebana schools with millions of adherents. There are two basic themes that are common to schools—the formal and the natural. The formal method bases its teachings on three main components in any arrangement, representations Heaven, Earth and Man. The natural method emphasizes the simplicity of the flower itself.

If you wish, you can spend some time learning *Ikebana* yourself. The Sogetsu School (Phone: 03-407-6181/5) offers a special class for foreigners. And JTB's "Art-Around-Town" tour in Tokyo includes a flower arranging demonstration.

TEA CEREMONY (CHANOYU)

Chanoyu is one of the things Japanese that fascinates visitors from overseas. Although some may think that the English are the world champion tea drinkers, the Japanese take it one step farther. They make a ceremony of drinking tea.

The tea ceremony was perfected by Sen-no-Rikyu in the 16th century, but its origin goes back many years before. Closely associated with the Zen sect of Bud-

dhism, the tea ceremony is supposed to create peace of mind in both the performer and partaker.

Here is how it is done...powdered green tea is scooped up with a small bamboo ladle and put in a deep bowl. Hot water is poured over the tea and a bamboo whisk is used to whip the mixture to a froth. The tea is then drunk by the participants. It is proper etiquette to drink slowly. The best way is to cradle the cup in your left hand, and turn it slowly three times, with your right hand grasping the rim. Drink slowly, preferably in three or four sips. Then place the cup gently on the *tatami* floor before you. It is also proper etiquette to examine the cup, but not too closely, and to remark on its elegance. Simplicity and elegance are essential in the tea ceremony.

Those who want to witness or participate in a tea ceremony should join the JTB "Art-Around-Town" tour of Tokyo.

JAPANESE GARDENS

The charm of the Japanese garden lies in its subtle, highly-sophisticated layout and in the representation of the essence of nature in a limited space.

Originally imported from China via Korea in the 5th or 6th century, Japanese gardening depicts nature as the designer interprets it, rather than merely reproducing it.

There are two types of Japanese gardens: The *tsukiyama* (hill garden) and the *hiranwa* (flat garden). For many years, most big gardens were the hill style; small gardens, the flat style. The two styles developed side by side, but with the introduction of the tea ceremony in the 14th century, the flat style underwent many innovations. The strong influence of Zen can be seen in many of the gardens of the Muromachi period (1338-1573), as most of them were designed by Zen priests. Gardening in Japan was at its glorious peak from the late 14th century until the mid-18th century.

Some of the representative gardens of these periods are still in

existence today: Muromachi Period—Moss Garden, Gold Pavilion and Silver Pavilion gardens, Ryoanji (Rock Garden), Daitokuji Temple garden, all of which are in Kyoto. Edo Period—Katsura Detached Palace, Shugakuin Detached Palace, Nijo Castle, old Imperial Palace in Kyoto. Famous Edo Period gardens in Tokyo are Rikugien, Korakuen and the Hama Detached Palace. Ritsurin Park in Takamatsu, Kenrokuen Garden in Kanazawa, and Korakuen Garden in Okayama are also outstanding works of this era.

KIMONO

Foreign visitors are often disappointed to learn that few Japanese wear Kimono, particularly in the cities. The reason is simple. A kimono is not only expensive, but also is not as easy to wear in this modern age as Western clothes.

Kimono patterns and colors are different, but cutting and style are almost uniform. Material is cotton or man-made fabric for everyday use, but the more expensive kimono is of silk. Accessories include an obi, sash and *haori* (a short overcoat). Other accessories that go with the kimono are: *juban* (underwear made of silk or cotton); smaller sashes; split-toed *tabi* socks; and *zori* or *geta*, footwear. *Zori* are often used for formal occasions, *geta* are informal and almost never worn on formal occasions.

The *yukata* is a gay cotton kimono and quite relaxing to wear. At a Japanese inn, you will have a chance to wear a *yukata*.

Why not take a stroll through the kimono section of a leading department store in Tokyo and Kyoto? Usually an entire floor is devoted to kimono and kimono accessories.

At either Amita Handicraft Center, Tokyo Shopping Center or Kyoto Handicraft Center, Kimono and Happi Coats can be purchased at a reasonable prices.

BRIDAL COSTUME

In Japan, the bride generally wears very elaborate *kimono*—three long-sleeved robes, one over the other. The outer is made of colored crepe-silk, with designs of flowers and birds of auspicious significance. The inner two are of pure white silk.

Her hair put up in *bunkin-take-shimada*, an ancient fashion, she wears a strange, box-like covering over her hairdo that is supposed to hide the "horns of jealousy."



KABUKI

Kabuki, the most colorful of all forms of traditional Japanese entertainment, is bustling, exaggerated drama accompanied by songs and music. It has been widely popular since its beginnings in the

17th century. But today, this traditional theatrical art faces strong competition from the entertainment of the younger set.

Kabuki differs from Western theater in many respects. It is a combination of acting, singing and dancing; it has a "*hanamichi*" (an approach to the stage through the audience, something like a runway on which the actors appear, giving a feeling of oneness with the audience) and a stage which between scenes revolves in full view of the audience, allowing quick, colorful scene changes; women's parts are played by male actors; exaggerated make-up is used to intensify the feeling of the character the actor portrays.

The pace of Kabuki is slow by today's standards, but the play is enlivened by gorgeous sets, costumes and the almost lyrical delivery of the lines. One unique feature of Kabuki is that the characters are assisted in making costume changes on the stage by silent men with covered faces dressed in black who are supposedly invisible to the audience.

The best place to see Kabuki in Tokyo is at the Kabukiza Theater (Phone: 541-3131) which has comfortable, Western-style theater facilities. For other theaters that present Kabuki drama, refer to page 36. The JTB Tokyo golden Night tour package includes kabuki drama at the Kabukiza Theater.



NOH

Noh is an ancient form of Japanese court dance. It is characterized by the use of masks and by stately dancing and staging to the accompaniment of instrumental music.

"Noh" simply means "performance," and evolved from Sarugaku, a form of entertainment that was popular in the 13th and 14th centuries. Sarugaku was refined by Kannami Kiyomasa (1333-1384) and his son, Zeami Motokiyo (1363-1443) gave Noh its present character.

The subjects of Noh plays are mostly historical and show Buddhist influence.

The Noh stage, 5.5 meters (18 feet) square, is much smaller than the Kabuki stage and is covered with an inner roof. The stage set is simple, usually just a huge pine tree painted on a backdrop.

Noh costumes are gorgeous and their effect is doubled on the bare Noh stage. Masks which take the place of the make-up used in other forms of dramatic art, are worn by the actors to indicate the characters portrayed.

The language, costumes and settings have not changed since the 16th century. Even today, Noh audiences are mainly connoisseurs rather than people seeking entertainment.

For where to see Noh Drama, refer to page 36

JUDO

Judo, developed in Japan is now a worldwide competitive sport.

The original form of judo, called *jujutsu*, developed in the Edo period (1603-1867). It was different systems of fighting, without weapons, against either an armed or bare-handed opponent.

Dr. Jigoro Kano (1860-1938), after mastering *jujutsu*, fostered judo and introduced scientific training systems based on modern athletic principles. He organized a modern school of judo known as *Kodokan judo*.

The fundamental principle of judo is to use the strength of the op-

ponent to advantage. Thus person of weaker physique can beat a stronger opponent. The judoists wear white coats, white trousers and colored belts, the color of which differs according to their rank.

The best-known judo hall in Japan is the Kodokan in Tokyo (Phone: 811-7151). From 5 to 7:30 p.m. you can see the training of the judoists at the hall (free).

KARATE

Karate is a technique of hitting or jabbing the opponent with the fist or kicking him off his feet. It rules out the use of a weapon.

Karate is ancient, developing over the centuries between the Tang and Ming periods in China. Later, it was introduced to Japan, and under the influence of the indigenous martial arts went through considerable modification.

In *karate* basic training, one is required to practice jabs, kicks, etc. over and over on a straw dummy. When one has been well trained in basic *karate* techniques, it is not difficult to break a dozen roof tiles or five boards with a single stroke.

Seibu Kan in Kyoto is the largest martial arts academy in the Orient where *karate* and other Japanese martial arts can be seen.

SUMO

Sumo is traditional Japanese wrestling. The wrestlers are professionals, tall and heavy, usually weighing from 200 to 350 pounds (90-160 kg.)

Fifteen-day Sumo tournaments are held six times a year—in January, May, and September at the Kuramae Kokugikan Hall in Tokyo; in March at Osaka; in July at Nagoya, and in November at Fukuoka. The tourney winner is awarded a champion's flag, a monetary prize and his name is engraved on the trophy awarded by the Emperor. Between tournaments, *sumo* wrestlers tour the country, competing in local matches.

Compared with Western wrestl-

ing, the rules of *sumo* are very simple. Two wrestlers, wearing only loincloths, enter a sanded ring 4.6 m. (15.3 feet) in diameter. If any part of a wrestler's body, except his feet, touches the ground or if he steps or is pushed out of the ring, he loses.

RYOKAN—JAPANESE INNS

The accommodations, facilities, and services in "Ryokan" or Japanese inns differ widely from those in Western-style hotels. If you wish to experience a different touch of Japan, the easiest way is to stay at a Ryokan.

How to act at a Ryokan

At the entrance, you are asked to remove your shoes before stepping onto the well-polished wooden floor. A pair of slippers will be offered. When you reach your room you must leave your slippers outside.

The *tatami* mat-floored Japanese room is a combined living, dining and bedroom. The *tatami* are made of rice straw covered with a thin woven mat.

Upon entering your room, you are asked to sign the register, and green tea and cakes are served.

A Japanese bath is delightful. The bath in a *Ryokan*, particularly at the hot-spring resorts that abound in Japan, is clean and spacious. Use soap outside of the tub. Soap, rinse and then get into the tub to soak and relax. Communal or private baths are available.

Japanese bedding or *futon* will be laid on the *tatami* floor by the maid at night.

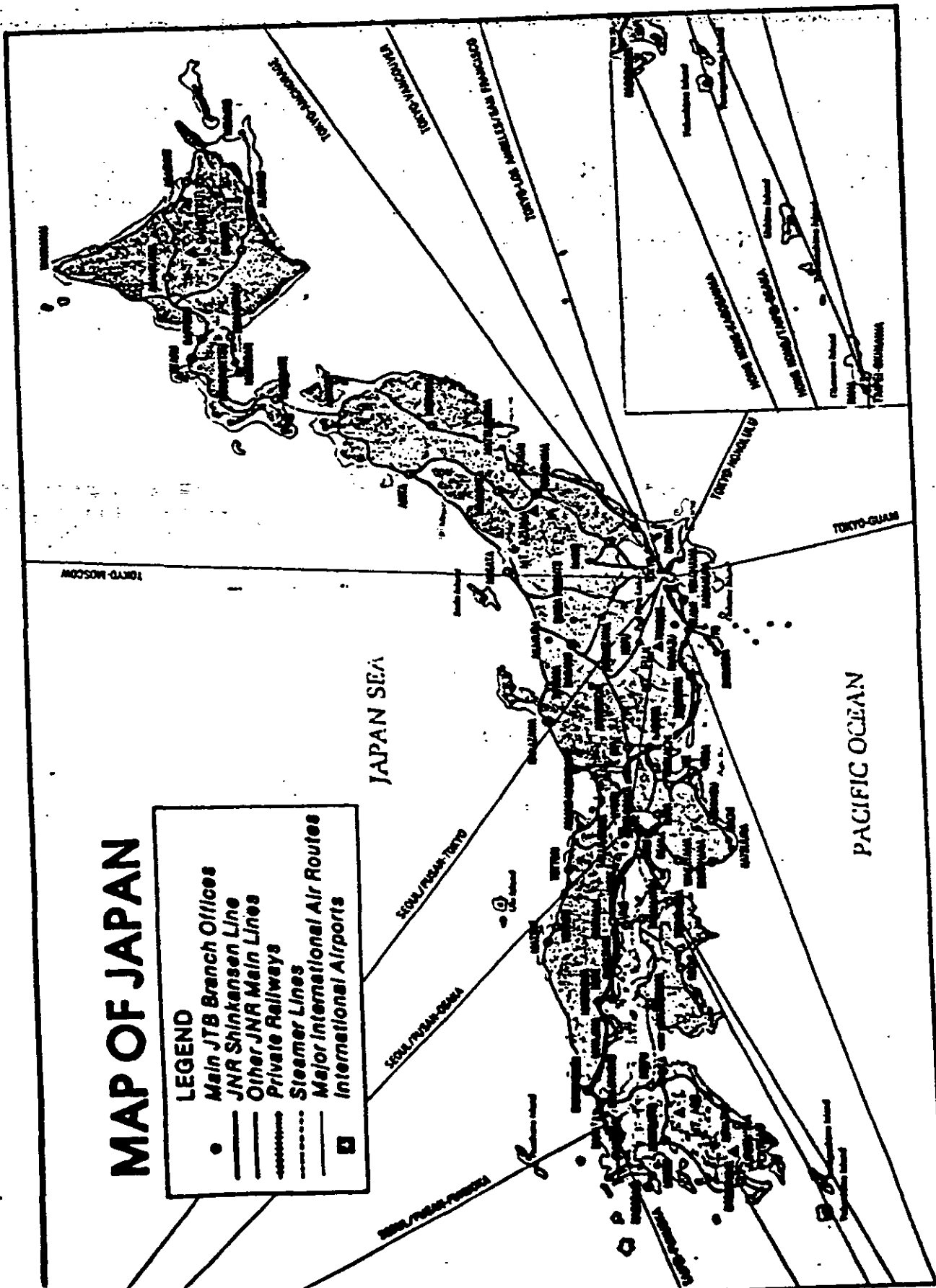
The maid will do all sorts of errands for you, press your clothes or send out your laundry, besides serving your meals and making your bed.

Japanese meals will be served by the maid who is assigned to your room. Two meals (breakfast and dinner) are ordinarily included in the room charge.

MAP OF JAPAN

LEGEND

- Main JTB Branch Offices
- JNR Shinkansen Line
- Other JNR Main Lines
- Private Railways
- Steamer Lines
- Major International Air Routes
- International Airports



DINING OUT

Food & Drinks
Japanese Delicacies
How To Use Chopsticks
How To Eat Inexpensively
Restaurants

FOOD AND DRINKS

Japan has many fine restaurants which serve excellent international cuisine, but we advise you to sample some of the delicacies of Japan.

The best introduction to Japanese cuisine is through internationally-famed dishes like *sukiyaki*, *tempura* and *yakitori*. Then, if you are the adventurous type, proceed to more typical Japanese foods such as *sushi* and *soba* (buckwheat noodles).

JAPANESE DELICACIES

Sukiyaki

Sukiyaki is delicious. Thin strips of beef, sliced green onions, vegetables in season, chunks of soybean curd, and *shirataki*, a gelatinous noodle, are gently simmered in a tasty mixture of *sake*, soy sauce and sugar. The whole process takes place right at your table.

When the *sukiyaki* is ready, you pluck morsels from the pot with your chopsticks, swish them through beaten raw egg (if you wish to be authentic), plunk them on the rice in the tiny rice bowl before you, and enjoy! And *sake* goes well with *sukiyaki*, try it. You can eat your fill of *sukiyaki* for ¥2,000—¥4,000 per person.



Tempura

Tempura came originally from Portugal, and was picked up by the Japanese in the 16th century. As it survives today, it is a delicious combination of shrimp, fish, seaweed, chrysanthemum leaves and various familiar vegetables. All the ingredients are dipped in a feather-light batter and deep-fried. That means the very best way to eat tempura is across the counter from the cook. That way, your tempura is placed on your dish piping hot and indescribably delicious. Just mix some of that grated daikon (radish) with the delicate sauce provided, dip your tempura in it, and a more delicious meal you'll never find. You can find places to eat tempura for ¥2,000—¥3,000 per person, but be prepared to pay more in the exclusive restaurants.

Yakitori

Yakitori is traditional with a drink of hot sake on a blustery winter day. But it is delicious any time of the year. Yakitori literally means roasted bird, but it is bits of chicken, giblets, onions and okra skewered on bamboo splinters and barbecued. The barbecue sauce is delightfully tangy. Yakitori is a good way to delve into the culinary wonders of Japan. The delicacy is sold by the stick, and costs anywhere from ¥50 to ¥200 per stick. Do not hesitate to ask prices before you eat.

Sushi

Japanese women would rather eat sushi than anything else in the world. But it takes an adventurous spirit for the average foreigner to try it. The dish is very simple. It is vinegared rice, squeezed into a bite-sized oblong and topped with various delicacies such as raw tuna, squid, broiled eel, sweet fried egg, boiled shrimp, fish roe and various other raw seafood. You had best start with boiled shrimp and fried egg. You can see everything available through the glass case on the counter so just point to what you want. If you want to try fresh fish,

it would be a good idea to start with the bright red one, lean *maguro* (tuna). Sushi is sold in pairs costing anywhere from ¥100 to ¥1,200 per set.

Tonkatsu

Tonkatsu is just the right Japanese dish for the meat-loving visitor. Literally, Tonkatsu means pork cutlet. But it really is breaded deep-fried pork, either boneless chops or luscious cuts of fillet. Order a *Tonkatsu Teishoku*, and you will probably get breaded pork, shredded cabbage, two slices of tomato, a bowl of *miso* soup, and green tea—all for the exorbitant price of ¥500 to ¥1,300. Just look for a *tonkatsuya*.

Noodles

Apparently Marco Polo brought noodles back from his adventures in China so Italy has spaghetti. Noodles also came to Japan from China. There are three basic kinds of noodles, any of which you will be safe in ordering. They are all delicious. There are: 1) buckwheat noodles called *soba*, 2) large white noodles called *udon*, and 3) thin egg noodles called *ramen* or *chuka soba*. All can be ordered in various dishes. All are a good introduction to a favorite Japanese food. Prices run from ¥300 to ¥750.

Rice

All rice does not come in little bowls at the side of your plate. There are also several kinds of one-dish rice meals. One of these is *donburi mono*. *Donburi mono* is a large bowl filled with rice and topped with different things such as a mixture of sliced chicken and egg, or tempura, or tonkatsu. *Donburi mono* are always good, so don't hesitate to try one.

Another rice-based one-dish meal is *Sake(salmon) Chazuke*. This is a bowl of rice over which tea has been poured. It is seasoned with *wasabi*, a kind of horseradish, chunks of salted salmon, strips of seasoned pressed seaweed and sesame seeds. Delicious!

HOW TO USE CHOPSTICKS

(Courtesy of Chinatown Restaurant)

Using Chopsticks

1. Hold the first chopstick firmly in fixed position.
2. The second chopstick is held as a pencil with the thumb, index and middle fingers. Move this chopstick to meet the end of the first chopstick.
3. This movement will form "V" to pick up the food.



The last traditional rice-based one-dish meal you may wish to try is *zōsui*. It is rice in a clear, subtly flavored soup with mushrooms, trefail, poached egg, and meat or seafood.

Any of these rice-based traditional dishes will delight the visitor. Best of all, they cost from ¥500 to ¥1,500 each. Why don't you try several?

Suntory Whisky & Beer

Both imported and domestic liquors are available at hotels, restaurants, night clubs and on limited-express trains. Imported liquors are expensive. The whisky made in Japan is quite reasonable and very good. We recommend that you try Suntory whisky, the nation's leading brand.

Japanese beer is also excellent. The popular brands are Suntory, Kirin, Sapporo, and Asahi. Japanese beer is more like a fine German lager than an American beer.

Danish-type beer is also available. If you like refreshing Danish-type beer, Suntory is the brand for you.

Sake is the traditional drink. Brewed from rice, it is sometimes called rice wine. Sake tastes best when served warm (some like it hot), but it is also refreshing on-the-rocks. Being the original Japanese drink, it goes well with Japanese food.

HOW TO EAT INEXPENSIVELY

If you are budget minded and want to mingle with the Japanese, go to one of the downtown areas of any city where there are many good eating places.

Window-Display Restaurants

Anywhere people congregate, you'll find restaurants with a show-window displaying samples of the food they serve. These are the restaurants the Japanese frequent and

they serve excellent food.

You can tell what kind of restaurant it is from the samples. The prices listed on the small cards beside the sample show what you pay for the food. No tax. No tipping.

You can tell the grade of the restaurant—as you would in your own country—from the outward appearance of the buildings, from the show-windows themselves, and from the prices.

If you find the restaurant and the food attractive, then enter and order. Sometimes you are required to pay beforehand at the register where you will receive meal tickets in exchange for your money. Take any vacant table and hand the tickets to the waiter or waitress.

Do not expect anyone to speak English in these restaurants. If you have trouble in ordering, take one of the waiters or waitresses out to the show-window and point to what you want.

RESTAURANTS

● Drivers Club Card available

Cuisine	Name	Location	Phone
TOKYO			
Barbecue	● Chuanan	Sekiguchicho	943-1111
Chinese	● Baka	Nakagyo	403-3911
	● Chiu Hing	Nishi-Shinjuku	431-7371
	● Kikaku	Yasukuchicho	580-0280
	● Lin Yuan	Shiba Park	432-4231
	● Sanyo Hanten	Tamachi	581-2451
Country cooking	● Furusato	Kami-Maguro	483-2310
French	● Chandonay	Roppongi	594-0854
	● Chir Figue	Nishi-Azabu	430-4718
	● Mami's	Sanyo Bldg., Griza	677-2621
German	● Kest's	Griza 5	571-4842
	● Lehmer's	Griza 5	571-1142
Italian	● Antonio's	Nishi-Azabu 3	438-1871
	● Picchi's	Azabu	583-4712
Japanese	● Happon	Shinjuku-Danmachi	443-3111
	● Jaku	Tsukiji	541-2381
Mitsubishi	● Zukuro	Azabaka 1	582-0841
Steak	● Sanyo	Roppongi	403-6211
	● Chuanan	Sekiguchicho	943-1111
Sushi	● Matsuyama	Aomi Yashiro	572-1837
	● Ohara	Griza 7	571-1417
	● Sushiro	Griza 6	571-6271
Sushi	● Edogiri	Tsukiji 4	543-4401
Sushi	● Sanyo Inn	Roppongi	584-0811
Tempura	● Agatsuma	Azabaka	541-0110
	● Chuanan	Sekiguchicho	943-1111
	● Nagai	Koyabacho	589-5501
	● Tan-ichi	Griza 6	571-1948
Western	● Bingham of New York	Griza 6	571-8280
	● Midway Cabin	Griza 5	574-8484
Yakitori	● Toron	Griza 8	571-2261

Cuisine	Name	Location	Phone
KYOTO			
Chinese	● Mei	Kyomachi	231-0253
	● Oka Hanten	Osaka	231-7348
	● Shin-Hanten	Kyomachi	222-0258
Japanese	● Chuanan	Nishijuku	251-1846
	● Hara	Kyomachi	241-2401
	● Rami	Azabaka	871-0019
Mitsubishi	● Juntoku	Gan Hanten	561-0213
	● Juntoku	Nishijuku	761-2311
	● Tanaka	Nishijuku	361-8001
	● Tanaka	Nishijuku	771-2650
Steak	● Roshomon	Shijo-Kawarabashi	221-5253
	● Sushiro Kyoto	Kawarabashi	221-7188
Sushi	● Juntoku	Nishijuku	761-2311
	● Minato	Azabaka	771-4185
	● Matsuyama	Sanyo-Tamachi	221-0001
Tempura	● Katsura	Nishijuku	561-2408
	● Yachiro	Nishijuku-Futaba	771-4148
Yakitori	● Yachiro	Nishijuku	561-5354
	● Matsuyama	Nishijuku	561-7121
OSAKA			
Barbecue	● Takao	Azabaka	351-8201
Chinese	● Zuan	Nishijuku	211-3782
Japanese	● Rudenaga	Rudenaga	771-1703
	● Kagura	Kagura	231-0272
	● Nishijuku	Dome	341-0582
	● Toron	Kyomachi	211-1019
Sushi	● Takao	Sanyo	313-2361
Tempura	● Toron	Kyomachi	211-2029
Western	● Matsuyama	Nishijuku	261-2241
Western	● Matsuyama	Nishijuku	231-1351

Grammar

In this text, the parts of speech are six. They are: 1) the verb, 2) the verbal adjective, 3) the copula, 4) particles, 5) sono-type noun modifiers, and 6) nouns. The first three of the series are conjugated, while the last three never change in form. A noun is defined as something which does not change in form and which is not a particle or a sono-type word. Thus, one must be aware that the noun category is quite broad.

The politeness levels have been divided into two categories--the semi-formal and the honorific or formal language. The informal level or familiar speech is also introduced in some of the later lessons in the pattern-passage conversations among members of the Yamada family. However, as the semi-formal and formal language is more commonly used with friends and acquaintances, these levels are the ones primarily taught. Within the levels of semi-formal and formal language, the endings of the conjugated forms (the verb, the verbal adjective, and the copula) may be informal or semi-formal. For example, the verb "eat" at the semi-formal level has an informal form taberu and a semi-formal form tabemasu; at the formal level, "I eat" has an informal form itadaku and a semi-formal form itadakimasu while "you eat" has the informal form meshiagaru and the semi-formal form meshiagarimasu.

Pronunciation

The five basic vowels in Japanese today are a, i, u, e and o. (For the pronunciation of these vowels it is recommended that one mimic the teacher or follow the tape.) Each of these vowels may be held, a becoming aa, i becoming ii, etc. In the case of the held vowels, aa, ii, etc., the single unit is simply held longer but never changes in quality.

The basic Japanese syllables are one of the above vowels, combinations of a consonant (or consonants) and one of the vowels, or the nasal "n." The following are the basic syllables. The forms in parentheses indicate the spelling used in this text.

a	ka	sa	ta	na	ha	ma	ya	ra	wa	n (nasal) (or m)
i	ki	si (shi)	ti (chi)	ni	hi	mi		ri		
u	ku	su	tu (tsu)	nu	hu (fu)	mu	yu	ru		
e	ke	se	te	ne	he	me		re		
o	ko	so	to	no	ho	mo	yo	ro		

ga	za	da	ba	pa
gi	zi (ji)		bi	pi
gu	zu	du (zu)	bu	pu
ge	ze	de	be	pe
go	zo	do	bo	po

kya (sha) (cha) nya hya mya rya

kyu (shu) (chu) nyu hyu myu ryu

kyo (sho) (cho) nyo hyo myo ryo

gya (ja) bya pya

gyu (ju) byu pyu

gyo (jo) byo pyo

(The syllables in parentheses in the last group are all palatalized.)

Mention must also be made of the so-called "whispered" vowels i and u. These are not indicated in the text, because it is hoped that students will not be looking at their texts and also that they will learn from mimicking the teacher. These vowels become whispered only when they occur between the consonants k, s, t and h, or as a final after one of these consonants. Examples are shita, huto, -masu ka, and iutatsu.

The student is also advised to use the nasal g in non-initial positions. This is the preferred pronunciation in the Tokyo dialect.

Accent

The pitch accent in Japanese is one to which English speakers are not accustomed and one to which they must pay special attention. Pitch may affect the meaning, as in the examples yonda and yonda, the former meaning "read" and the

latter meaning "called." Within an utterance, that is, between two pauses, there may be several pitch accents but they are not all the same height in pitch. It is recommended that one listen closely to the teacher's pronunciation of pitch.

There are four patterns of pitch. An illustration with nouns and proper names as examples would be the following four types: 1) head-high, Shimizu, 2) intermedially-high, Yoshimura, 3) tail-high, yama desu, and 4) flat (in which the first syllable of the series is somewhat lower than the remainder), Tanaka. Accent marks are indicated in the text in the above manner. Pitch marks have been omitted from the sections which the students might be seeing in class, such as the exercise section. Thus, in class recitation, there is a check on the student to see if he has memorized the proper pitch for each phrase. The pitch patterns followed in this text are those of the Tōkyō dialect which is the basis for standard Japanese today. However, accents change from generation to generation and there are some which are now in a state of flux. In such cases, an attempt has been made to use the one which is most prevalent. Pitch accents of individual words have been based on the reference work, Nihongo Akusento Jiten by Haruhiko Kindaichi.

UNIT I

LESSON 1

Yukio: Ohayoo gozaimasu.¹
Okaasan: Ohayoo gozaimasu.
Yukio: Nanji desu ka?
Okaasan: Shichiiji desu.
(sitting down to eat)
Yukio: Itadakimasu.²

Yukio: Good morning.
Mother: Good morning.
Yukio: What time is it?
Mother: It's seven o'clock.
Yukio: Itadakimasu.

GRAMMAR

I-1.1 The copula desu

Desu has the meanings "am," "is" and "are" and the choice of meaning is determined by context. In this lesson, desu appears only after nouns.

EXAMPLES:

Yukio desu.

Tokee desu.

Ichiji desu.

I am Yukio (literally, "am Yukio").
It's Yukio (literally, "is Yukio").
It's a clock (literally, "is a clock").
They are clocks (literally, "are clocks").
It's one o'clock (literally, "is one o'clock").

I-1.2 Nouns

In the case of most Japanese nouns, there is no distinction in form between singular and plural. For example, tokee may mean "clock" or "clocks"; context determines which meaning is intended.

I-1.3 -san

San is a suffix which is added to names of people as an expression of politeness. It also occurs after names of jobs or professions when referring to individuals in those professions. It is comparable to the use of "Mr.," "Mrs." and "Miss" in English. SAN IS NEVER ADDED WHEN GIVING ONE'S OWN NAME.

EXAMPLES:

Yukio-san desu.
Hon'ya san desu.

It's Yukio.
It's the bookseller.

I-1.4 Interrogative particle ka

The particle ka occurring at the end of a sentence makes the sentence an interrogative one.

EXAMPLES:

Yukio-san desu.
Yukio-san desu ka?
Ichiji desu ka?

It's Yukio.
Is it Yukio?
Is it one o'clock?

Tokee desu ka?
Nan desu ka?

Is it a clock? Do you mean a clock?
 What is it?

(Nani is an interrogative word meaning "what." The form nan occurs rather than nani before a word beginning with "d," such as desu and also before counters (to be discussed later) such as ji meaning "o'clock" as in nanji, "what hour" or "what o'clock." Both the forms nan and nani occur interchangeably before a word beginning with "t" or "n." (Before other consonants or vowels, nani occurs.)

I-1.5 ...ka, ...ka

Two interrogative sentences of similar pattern uttered in sequence indicates choice; "is it _____ or is it _____" is the meaning.

EXAMPLES:

Ichiji desu ka, niji desu ka?
Tanaka-san desu ka, Yamada-san
 desu ka?

Is it one o'clock or is it two o'clock?
 Is it Mr. Tanaka or is it Mr. Yamada?

GREETINGS AND PLEASANTRIES

Ohayō gozaimasu -- good morning

Konnichiwa -- good afternoon (day)

Konbanwa -- good evening

Oyasumi nasai -- good night (upon retiring for the evening)

Hajimemashite. Doozo yoroshiku -- this is the first time I have had the pleasure of meeting you. Please regard me well [literally].

Shibaraku deshita -- I have not seen you for some time.

Ogenki desu ka? -- How are you?

Okagesama de, genki desu. -- Thank you for asking. I am fine.

Saiko! -- "Great!" or "Excellent!", i.e. couldn't be better

Ma ma desu -- so, so

Anata no namae wo oshiete kudasai -- Please teach me your name [literally].

Onamae wa nan to osshaimasu ka? -- What's your name [extreme polite form].

Watashi/watakushi no namae wa _____ desu. [NOTE: do not use the suffix -san when referring to yourself.].

Isogashi desu ka? -- Are you busy?

Hima desu ka? -- Is it a slack time?

Gomen kudasai -- Please excuse me.

Shitsurei shimasu -- " " ". Pardon my rudeness [literally].

Ojama shimasu -- Sorry to disturb you (e.g. upon entering someone's office or living quarters).

Sumimasen or chotto sumisen -- Excuse me (when interrupting a conversation or attempting to attract attention).

Nihongo wo hanashimasu ka? -- Do you speak Japanese?

Hai. Hanashimasu. -- Yes. I speak Japanese.

Hai. Sukoshi hanashimasu. -- Yes. I speak a little Japanese.

Iie. or Hai. Hanashimasen. -- No. I do not speak Japanese.

Eigo wo hanashimasu ka? -- Do you speak English?

Motto yukkuri hanashite kudasai. -- Please speak more slowly.

Mo ichido iite kudasai. -- Please repeat (your last statement).

Kaite kudasai. -- Please write (it).

Kaite agemashoo ka? -- Shall I write it for you?

Doo yatte kakimasu ka? -- How do you write it?

Ko yu fu ni kakimasu ka? -- Is this how it is written?

Wasurenai yo ni kaite okimasu. -- I will write it down so that I won't forget it.

Gokkuro sama desu/deshita [present/past tense] -- You've been very helpful (in the course of your duties).

Osewa sama deshita -- you've been very helpful (beyond the call of duty).
[Thank you for your help. I owe you a favor].

Osewa ni narimasu -- I will be in your debt (for your help above and beyond the call of duty).

Iro iro to, doomo arigatoo gozaimasu. -- Thank you for your many favors.

Arrigatoo gozaimasu. -- Thank you.

Yoroshi desu ka? -- Is it okay? or is that alright?

Tanoshimi ni shite imasu. -- I'm looking forward to it with pleasure.

Nihongo no benkyoo wa muzukashii desu ne? -- The study of Japanese is difficult, isn't it?

Dewa kore de shitsurei shimasu. -- (The matter is completed). I will leave you now. Excuse me.

Soro soro shitsurei shimasu. -- I must leave shortly. Please excuse me.

HEALTH AND WELL BEING

Go kigen ikaga desu ka? -- How is your health?

Donna guai desu ka? -- How severe is it?

Onaka ga itai desu. -- I have a stomach ache.

Atama ga itai desu. -- I have a headache.

Kibun ga warui desu. -- I do not feel well.

Funayoi desu. -- I am seasick.

Funayoi de wa arimasen. -- I am not seasick.

Geri -- diarrhea

Tsukarete imasu. -- I am tired/weary.

Tsukarete imasen. -- I am not tired/weary.

Nemui desu. -- I am sleepy.

Nemuku arimasen. -- I am not sleepy

Nemutai desu. -- I want to sleep.

ABUNAI! -- DANGER, LOOK OUT!

Shimpai shite imasu ka? -- Are you worried?

Shimpai shinai de kudasai. -- Please do not worry.

Daijobu desu. -- I am okay. There is no need to worry.

MEALS

Itadakimasu. -- I begin to eat/drink [literally]. [Before beginning to eat or drink in company]. Bon appetite.

Itadakimasu. -- I'll have some (when offered food during meals).

Gochiso sama deshita. -- Thank you for the meal/drink.

Ohashi -- chopsticks

Hoomu -- fork

Osaji -- spoon

Naifu -- knife

Sara -- plate; ko sara -- small plate.

Chawan -- rice bowl

koppu -- glass

Tabemasu. -- I eat/will eat.

Tabemashoo. -- Let's eat.

Tabemashoo ka? -- Shall we eat?

Onaka ga sukimashita. -- I am hungry.

Gohan, meshi -- cooked rice (synonymous with "meal")

Cho shoku, asa han, burekufastu -- breakfast

Chu shoku, hiru han -- lunch

Yu shoku, yu han -- dinner

Tabetai desu. -- I would like to eat it/some.

Tabetaku nai desu. -- I do not want to eat it/some.

Hambun -- half full

Sukoshi -- a little bit

Mo sukoshi -- a little more

Motto sukunaku -- a little less

Juubun desu. -- that's enough

O sugimasu. -- too much

Mo ii desu! -- That's enough!

Mo kekko desu. -- No, thank you.

Mo takusan itadakimashita. -- I have had much to eat.

Mo takusan desu. Arigato gozaimasu. -- I've had enough, thank you.

Onaka ga ippai desu. -- I'm full.

Tabete sugimashita. -- I ate too much.

Genshoku wo shite imasu. -- I'm on a diet.

Shokuji no ato, shigoto wo shimasu. -- After I am finished eating, I will have to work.

_____ wo nomitai desu. -- I would like to drink some _____.

_____ wo tabetai desu. -- I would like to eat some _____.

_____ arimasu ka? -- Is there some/any _____.

Oishii desu. -- It is delicious.

Pan -- bread

Sakana -- fish

Nikku -- meat

Gohan -- cooked rice

Ika -- squid, cuttlefish

Gyu nikku -- beef

Kome -- uncooked rice

Tako -- octopus

Buta nikku -- pork

Tsubu -- a rice kernel

Nori -- dried seaweed

Tori nikku -- fowl

Tamago -- egg(s)

Kyabetsu -- cabbage

Konbu -- laver (seaweed)

Kare raisu -- curried rice

Ninjin -- carrots

Tofu -- soybean curd cake

Karashi -- hot, yellow mustard

Nanban -- bellpeppers

Takenoko -- bamboo shoots

Wasabi -- pungent, green mustard

Tamanegi -- onions

Shiitake -- dried mushrooms

Ocha -- green tea

Tomato -- tomato

Ringo -- apple

Kocha -- black tea

Jaga imo -- potato

Nashi -- pear

Kohi -- coffee

Serori -- celery

Banana -- banana

Nomi mizu, mizu -- drinking water

Kyuri -- cucumber

Orenji, mikan -- orange

Tsuma yoji -- toothpick

Biiru -- beer

Biiru ippai -- glass of beer

Biiru ippon -- bottle of beer

Ouisky -- whiskey

Koori -- ice

Koppu -- glass

Kampai -- cheers

Yopparate imasu -- drunk (tipsy)

ORDINAL NUMBERS

ichi -- one	ju-ichi -- eleven	ni ju-ichi -- twenty one
ni -- two	ju-ni -- twelve	ni ju-ni -- twenty two, etc.
san -- three	ju-san -- thirteen	san ju -- thirty
yon, shi -- four	ju-yon -- fourteen	yon ju -- forty
go -- five	ju-go -- fifteen	go ju -- fifty
roku -- six	ju-roku -- sixteen	roku ju -- sixty
shichi, nana -- seven	ju-shichi -- seventeen	nana ju -- seventy
hachi -- eight	ju-hachi -- eighteen	hachi ju -- eighty
ku, kyu -- nine	ju-ku -- nineteen	kyu ju -- ninety
ju -- ten	ni ju -- twenty	hyaku -- hundred
		ni hyaku -- 200
		san byaku -- 300
		roppyaku -- 600
		happyaku -- 800
		sen -- 1,000

Counters:

For animals --

_____ to = _____ animal
 it to -- 1 animal
 ni to -- 2 "
 san to -- 3 "
 yon to -- 4 "
 go to -- 5 "
 etc.

General counter --

hitotsu -- 1 ju ichi -- 11
 futatsu -- 2 etc.
 mitsu -- 3
 yotsu -- 4
 itsutsu -- 5
 mutsu -- 6
 nanatsu -- 7
 yatsu -- 8
 kokonotsu -- 9
 to -- 10

e.g. Kyo wa iruka nan to gurai agarimasu ka? -- Approximately how many porpoise will be transferred (to the mothership).

Saisho no iruka wa dai tai nanji goro agarimasu ka? -- Approximately when will the first porpoise be transferred (aboard the mothership).

Gozenchu made iruka nan to gurai agarimasu ka? -- Approximately how many porpoises will be transferred (to the mothership) in the morning.

Go go ni iruka nan to gurai agarimasu ka? -- Approximately how many porpoises will be transferred (to the mothership) in the afternoon.

TIME

Ima nanji desu ka? -- What time it?

Itsu desu ka? -- When?

ima -- now

sugu -- immediately

mada -- not yet

soro soro -- if a few minutes

ato de -- later

kono mae -- the time before

kondo, konkai -- this time

tsugi ni -- next time

ichinichi ni ikkai -- once a day

Dono gurai kakarimasu ka? -- About how long will it take?

Ni jikan kakarimasu. -- It will take two hours.

San jikan kakarimasu. -- It will take three hours.

Ni jikan gurai kakarimasu. -- It will take about two hours.

Ni jikan mo kakarimasu. -- It will take at least two hours.

Bosen ni nanji goro tsukimasu ka? -- At what time will we rendezvous with the mothership.

Bosen kara nanji goro shuppatsu shimasu ka? -- At what time will the catcherboat depart from the mothership?

Itsu dekimasu ka? -- When will it be ready?

Itsu okorimashita ka? -- When did it occur?

Jikan ga arimasu ka? -- Do you have time?

Jikan ga arimasen. -- There is insufficient time. I do not have sufficient time.

osoi -- slow

hayai -- fast

kyo -- today

kino -- yesterday

kino no asa -- yesterday morning

kino no gogo -- yesterday afternoon

kino no yugata -- yesterday, near sunset

kino no yoru -- yesterday evening

ototoi -- day before yesterday

ashita -- tomorrow

ashita no asa -- tomorrow morning

ashita no gogo -- " afternoon

ashita no yoru -- " evening

asatte -- day after tomorrow

konshu -- this week

senshu -- last week

raishu -- next week

kotoshi -- this year

sen nen -- last year

rai nen -- next year

mai nichi -- every day

mai shu -- every week

mai tsuki, mai getsu -- every month

mai nen -- every year

ichinichi -- one day

futsuka -- two days

mikka -- three days

yokka -- four days

itsuka -- five days

muika -- six days

nanoka -- seven days

yooka -- eight days

kokonoka -- nine days

toka -- 10 days

(NOTE: add the suffix -kan to indicate a period of time, e.g. muika-kan (six day period),

_____ nen -- _____ year(s) [Insert ordinal number].

Names of the Months:

getsu, gatsu -- month

ichi gatsu -- January

ni gatsu -- February

san gatsu -- March

shi gatsu -- April

go gatsu -- May

roku gatsu -- June

shichi gatsu -- July

hachi gatsu -- August

ku gatsu -- September

ju gatsu -- October

ju ichi gatsu -- November

ju ni gatsu -- December

gatsu no hajime --
first third of the
month.

gatsu no chujun --
mid-third of the
month.

gatsu no geijun --
last third of the
month.

Days Of The Week:

Nichiyobi -- Sunday

Getsuyobi -- Monday

Kaiyobi -- Tuesday

Suiyobi -- Wednesday

Mokuyobi -- Thursday

Kinyobi -- Friday

Doyobi -- Saturday

Do, Nichi -- Saturday and Sunday

Kyo wa nan yoobi desu ka? -- What day of the week is it?

Kyo wa nan nichi desu ka? -- What date is it?

Kyo no hi nichi wa nan desu ka? -- What is today's date and day of the week?

Time Clock:

ippun -- one minute

nifun -- two minutes

sanpun -- three minutes

yonpun -- four minutes

gofun -- five minutes

roppun -- six minutes

nanafun -- seven minutes

happun -- eight minutes

kyufun -- nine minutes

jippun -- ten minutes

ju ippun -- 11 minutes

ni jippun -- 20 minutes

san jippun -- 30 minutes

yon jippun -- 40 minutes

go jippun -- 50 minutes

ichiji kan -- one hour

byo -- second

fun, pun -- minute

ji -- hour

(NOTE: e.g. ni - sanpun = 2-3 minutes
go - roppun = 5-6 "

reiji, mayonaka, midonighto -- midnight

ichiji -- 1:00 a.m.

niji -- 2:00 a.m.

nijuji -- 20 o'clock = 8:00 p.m.
(on 24-hr clock)

_____ji han -- 30 minutes past the hour

_____ji jugofun -- 15 minutes past the hour

_____ji jugofun mae -- 15 minutes before the hour

Goji goro ni tabemasu. -- We will eat around five o'clock.

WEATHER

kisho -- weather

Tenki wa do desu ka? -- How is the weather?

Yoi tenki desu. -- The weather is good/fair.

Warui tenki desu. -- The weather is bad.

Otenki wa yoku natta yoo desu. -- It looks as if the weather has turned fair.

Otenki wa yoku nasaso desu. -- It looks as if the weather is poor.

ame -- rain

kumori -- cloudy

kiri -- fog

toki doki hare -- intermittent clearing

gasu-ame -- mist

gasuke -- hazy

kosame, kirisame -- drizzle

hare -- clear

Ame ga futte imasu. -- It is raining.

Ame ga furiso desu. -- It looks as if it will rain.

kaze -- wind

kaze no hoko -- wind direction

kita yori no kaze -- wind from the north

minami yori no kaze -- wind from the south

higashi yori no kaze -- wind from the east

nishi yori no kaze -- wind from the west

hokkusei yori no kaze -- wind from the northwest

hokkuto yori no kaze -- wind from the northeast

nansei yori no kaze -- wind from the southwest

nanto yori no kaze -- wind from the southeast

e.g. nansei yori no kaze, mata wa hokkusei yori no kaze, kumori, toki doki hare = southwest wind changing to northwest wind, cloudy, intermittent clearing.

bofuke -- very strong winds

bofuke chui iiho = strong wind warning

shike -- storm

shikete kimasu -- a storm is brewing.

nagi -- sea conditions

nagi ga ii -- the sea conditions are calm/good

nagi ga warui -- sea conditions are rough

samui -- cold

tsumetai -- cold to the touch, e.g. tsumetai mizu -- chilled water

nukui -- warm to the touch

atsui -- hot to the touch

attakai -- warm (in reference to kion, air temperature)

teikyast -- high pressure zone

fokyast -- low pressure zone

taifu -- typhoon

mirribaru -- millibars of mercury, barometer reading

shikai -- field (range) of vision

mitoshi -- visibility

SHIPBOARD AND SEA TERMS

sendan-cho -- fleet commander

gyoro-cho -- fishing master (catcherboat)

sendo -- fishing master (catcherboat)

sen-cho -- captain

cho sa -- chief officer

secondo offisa -- second officer

kikan-cho -- chief engineer

kyoku-cho -- chief radio operator

bosun -- chief boatswain's mate

isha -- (ship's) doctor

tsuyaku -- interpreter

Suisan cho kanto kan -- Japan Fisheries Agency inspector

noru kumin -- vessel's ordinary seamen

gyoro bu -- fishing section

seizo bu -- processing section

sanma gata -- saury fishing configuration

tororu gata -- stern trawl configuration

nawa gata -- longline configuration

doko sen -- catcherboat

senko sen -- scoutboat

bosen -- mothership

kanshi sen -- fishery inspection vessel

Kawasaki boato -- Kawasaki boat, i.e. utility boat

hidari, po -- port

migi, stabo -- starboard

mae -- bow

stan, tomo -- stern
buridji -- bridge
uppa -- flying/upper bridge
kikai -- machinery
reida -- radar
onpa -- sonar waves
denpa -- radio waves
shuhatsu -- frequency
rajio bouy -- radio bouy
reida bouy -- radar bouy
aba sen -- corkline
do sen -- leadline
tan -- 50 m of webbing complete with corkline and leadline
nagashi ami -- drift net (gill net)
ami no me -- mesh size of webbing
suion -- water temperature
suion ki -- water temperature recording device
kaze hoko -- wind direction
fuko ki -- anemometer (direct reading)
kion -- air temperature
shinko hoko -- ship's heading in degrees true
NNSS -- satellite navigation equipment
ichi -- position
genzai ichi -- present position
eido -- position latitude
keido -- position longitude
do -- degrees fun, pun -- minutes byo -- seconds

e.g. yonju kyu do goju yon pun nosu, hyaku nana ju san do, san ju ni fun easto =
49° 54' N x 173° 32 E

tomo -- gillnet set

yomo -- gillnet haul

Tomo ichi made kyori to jikan wa donno gurai arimasu ka? -- What is the approximate distance and time to the set position?

Ato, tomo ichi made kyori to jikan wa donno gurai arimasu ka? -- What is the approximate distance and time remaining until we reach the set position.

Tomo ichi wo oshiete kudasai. -- Please give me the set position.

NNSS no tsukai kata wo oshiete kudasai. -- Please teach me how to read the satellite navigation equipment readout.

Ashita no asa (asu no, myocho no) yomo wa nanji ni hajimarimasu ka? --
At what time tomorrow morning is the net haul scheduled to begin?

tochaku jikan -- rendezvous time

shupatsu jikan -- departure time

yokozuke -- two vessels will come alongside

kaizu -- chart

kairyu -- current

nikkei hyo -- daily catch (of marine mammals)

gyoba -- fishing area

uneru -- swell

uneru no hoko to takasa -- direction and height of the swell

mizu age -- offloading of catch

hyo haku -- drift

hyo haku chu -- drifting

para anka -- sea anchor

hokkyu -- refuel

shokuryo -- food supplies

kaisui -- sea water

ma mizu -- fresh water

BIOLOGICAL TERMINOLOGY

honyu doobutsu -- marine mammals

Fluked Marine Mammals:

ishi iruka -- Dall's porpoise ✓

rikuzen iruka -- True's porpoise

nezumi iruka -- harbor porpoise

kama iruka -- Pacific white sided dolphin ✓

kita semi iruka -- northern right whale dolphin

shachi -- killer whale

koiwashi kujira, minku -- minke whale

nagasu kujira -- fin whale

shiro nagasu kujira -- blue whale

zato kujira -- humpback whale

koku kujira -- grey whale

semi kujira -- northern right whale

hokkyoku kujira -- bowhead whale

makko kujira -- sperm whale

Flipped Marine Mammals:

ottose -- northern fur seal ✓

todo -- northern (Steller's) sea lion ✓

azarashii -- harbor seal

rakko -- sea otter

Fish:

gin shake -- silver salmon

suke shake -- chinook salmon

bene shake -- sockeye salmon

shiro shake -- chum salmon

masu -- pink salmon

Salmo gairdnerii
Omasu or nijimasu ← steelhead trout
(krafamasu) -- steelhead tetsu or gashiva
suke ^{Alaska} zōdava pollock

- 19 -

hokke -- atka mackerel

mizu uo -- dagger tooth

moka same -- salmon shark

sami same -- Pacific sleeper shark

Seabirds = umidori (The following order corresponds to the poster displayed on most catcherboats.).

A. hashiboso mizunagidori -- short-tailed shearwater

B. hai-iro mizunagidori -- sooty shearwater

C. furuma kamome -- northern fulmar

D. hai-iro umi tsubame -- fork tailed storm petrel

E. hashibuto umi garasu -- thick-billed murre

F. umi garasu -- common murre

G. tsunomedori -- horned puffin

H. etopirika -- tufted puffin

I. etorofu umi suzume -- crested auklet

J. ko umi suzume -- least auklet

K. umi suzume -- ancient murrelet

L. umi omu -- parakeet auklet

M. uto -- rhinoceros auklet

Miscellaneous:

tori -- bird

ko tori -- small bird

ika -- squid

kurage -- jellyfish

kairopa -- bull kelp

kaiso -- seaweed (general term)

Anatomical and Related Terms for the Dissections:

taicho -- total length

seibetsu -- sex

ossu -- male

mesu -- female

taiji -- fetus

atama -- head

teeth -- ha

me -- eye

brohoru -- blowhole Kokyūko

mimi -- ear

sebire -- dorsal fin

oba -- flukes

oppai -- mammary glands

ennankotsu -- epiglottis

hai -- lungs

kanzo -- liver

shinzo -- heart

kidney -- jinzo

pancreas -- suizo

ii bukuro -- stomach

okakumaku -- diaphragm

gall bladder -- tan _____

lymph -- rimpa (eki)

hone -- bone

nankotsu -- cartilage

sebone -- axial skeleton

ranso -- ovary

Shibō -- blubber

kiseichu -- parasite(s)

shikyu -- uterus

kogan -- testis

Useful phrases:

Taicho wo hakkate kudasai. -- Please measure the total length (of the animal).

Taicho wa donno gurai arimasu ka? -- What is the total length (of the animal).

Ossu desu ka? Mesu desu ka? -- Is it a male or a female?

Nanbansen ga hokkaku shimashita ka? -- What is the number of the catcherboat recording the take?

Kono iruka hokkaku shita dokosen no bango to namae wo oshiete kudasai. -- Please teach me the number and the name of the catcherboat which took this porpoise.

Raberu wo kaite kudusai. -- Please prepare the specimen tag (label).

sampuru, mihon -- (biological) specimen, sample

_____ no sampuru wo totte kudasai. -- Please collect the _____ sample

e.g. shinzo no sampuru wo totte kudasai. -- Please collect the heart tissue specimen.

_____ no sampuru wo torimashita ka? -- Did you collect the _____ specimen?

e.g. kanzo no sampuru wo torimahsita ka? -- Did you take the liver specimen?

Miscellaneous Helpful Words/Phrases:

toiretto peipa -- toilet tissue

toire, benjo -- toilet

ofuro (furo) -- bath tub

furoba -- bathroom

senmenjo -- wash basin

oyu -- hot water

mizu -- cold water

sekken -- bath soap

shampoo -- shampoo

toweru -- towel

surippa, sandaru -- slippers

senzai -- wash soap

sentaki -- washer

dasui -- spin damp dryer

sentaku -- laundry

sentaku kakeru to ko -- place to hang up clothes to dry

jisho -- dictionary

ei-wa jiten -- English to Japanese dictionary

wa-ei jiten -- Japanese to English dictionary

keisanki -- calculator

noto -- notebook

toke -- clock

shimbun -- newspaper

zasshi -- magazine

haizara -- ash tray

denki -- electricity

denryu -- electric current

kiyomi -- interest

gurai -- about

daitai -- about, in general, almost

onaji -- same

chigau -- different

Kaki chigai de wa arimasen ka? -- Isn't this recorded erroneously?

dokushin, chonga -- bachelor

kekkon -- marriage

koibito -- girlfriend

kazoku -- family

chichi -- (my) father otosan -- (your) father

haha -- (my) mother okasan -- (your) mother

kyodai -- brothers and sisters

imoto -- younger sister ane -- older sister

ototo -- younger brother ani -- older brother

itoko -- cousins otoko -- male onna -- woman

ojisan -- grandfather kodomo -- children akambo, akachan -- baby

obasan -- grandmother

_____ san wa nan nin kyodai imasu ka? -- Mr. _____, how many brothers
and sisters do you have?

Ippai desu. -- it is full.

Kara desu. -- it is empty.

Mo arimasen -- there is no more.

Do shite? -- Why?

Do shite desho. -- What do you think?

ooki -- large chisai, komai -- small

Matte imasu. -- I will wait.

Machimasho. -- Let's wait together.

Matte ite kudasai. -- Please wait.

Chotto matte ite kudasai. -- Please wait for a moment.

Omachido sama deshita. -- I apologize for keeping you waiting (polite form).

Omatase shimashita. -- I apologize for keeping you waiting (less polite form).

Ima no uchi ni shite shimaishoo. -- Let's finish it now.

Gogo " " " . -- " " this afternoon.

Asa " " " . -- " " this morning.

Ashita " " " . -- " " tomorrow.

Moo dekimashita. -- It is done already.

Moo kansei shimashita. -- It is completed already.

Shigoto wo owarimashita. -- The work is finished.

Sore wo hayaku yaritai desu. -- I want to do that quickly.

Oshiete kudasai. -- Please teach me.

_____ wo kudasai. -- Please give me a/some _____.

Sore wo kudasai. -- Please give me that.

Mitai desu. -- I would like to see it.

_____ wo mini ikitai desu. -- I want to go and see the _____.

Sore/kore wa Nihongo/Eigo de nanto iimasu ka? -- How do say that/this in Japanese/English?

Kono yoo ni shite kudasai. -- Please do it this way.

Ima made wa soo shite kimashita ga, kore kara wa koo shite ikimashoo. -- We have been doing it this way, but from now on, let's do it this way.

Kangae naoshimashita. -- I have reconsidered.

Kamaimasen. -- it doesn't make any difference.

Shikata ga arimasen. -- It can't be helped.

Sore wa ii kangae desu. -- That is a good idea.

Do omoimasu ka? -- What do you think?

Watakushi/watashi mo so omoimasu. -- I agree with you.

Joozu ni narimashita. -- He has become skilled.

Yoku shimashita. -- You did it well.

Shigoto ga takusan arimasu. -- There is a lot of work to do.

Ato ga raku desu. -- The remainder is easy.

Jibun de yarimasu. -- I will do it myself.

Mochimasu. -- I have it or I'll carry it.

kekko desu. -- That's okay. That's excellent.

Daijobu desu. -- no problem. No need to worry.

Ryokai shimashita. -- I understand.

Wakarimashita -- I understand.

Ikutsu arimasu ka? -- How many are there?

Doko ni arimasu ka? -- Where are they?

Migi desu. -- It's on the right.

Hidari desu. -- It's on the left.

Massugu desu. -- It's straight ahead.

Toi desu ka? Chikai desu ka? -- Is it far or close by?

Teineit ni -- conscientiously, carefully

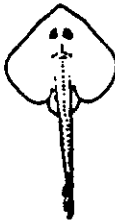
Appendix A



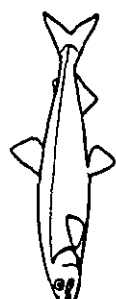
Dall's porpoise I SHI IRUKA
northern fur seal OTTOSEI
flying squid AKA IKA
boreal clubhook squid TSUME IKA
eight-armed squid TAKO IKA
pomfret SHIMAGATSUO
albacore TONBO, BINCHO, BINNAGA
yellowtail BURI, HAMACHI
skipjack KATSUO
blue shark YOSHIKIRI ZAME



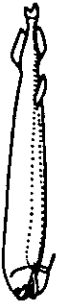


Appendix C

Pacific white-sided dolphin KAMA IRUKA
northern right whale dolphin SEMI IRUKA
common dolphin MAI IRUKA
striped dolphin SUJI IRUKA
short tailed albatross (Diomedea albatrus)?
black-footed albatross (Diomedea nigripes)?
Laysan albatross KAOHŌ DORI
sooty shearwater HAIRO MIZUNAGI DORI
short tailed shearwater HASHIBOSO MIZUNAGI DORI
(pale-) flesh-footed shearwater (Puffinus carneipes)?
Buller's shearwater (Puffinus bulleri)? (New Zealand)?
tufted puffin ETOPIRI KA
horned puffin TSUNOME DORI
Leach's storm-petrel (Oceanodroma leucorhoa)?
northern fulmar (Fulmaris glacialis) FURUMA KAMOME
marine turtles KAME
salmonids (SAKE, MASU)
 chinook MASUNOSUKE
 coho GINZAKE (GINMASU)
 chum SHIROZAKE (SAKE)
 pink KARAFUTOMASU
 sockeye BENIZAKE, BENIMASU
 steelhead SUCHIIRUHEDDO, GINSUKE

Scientific name	English common name (INPPC preference first)	Japanese standard name or name assigned specifically for INPPC use*	標準和名 又は INPPC 使用名称*
<u>PETROMYZONTIDAE</u>			
<u>Lampetra tridentata</u>	Lampreys Pacific lamprey	Yateume unagi-ka Yufutsu yateume	ヤツメウナギ科 ユウフツヤツメ
<u>CHIMAERIDAE</u>			
<u>Hydrolagus colliei</u>	Chimaeras, Ratfishes Spotted ratfish, Ratfish	Ginzame-ka (Ginzame no isshu)	ギンザメ科 (ギンザメの一種)
<u>SQUALIDAE</u>			
<u>Somniosus pacificus</u>	Dogfish sharks Pacific sleeper shark	Taunozame-ka Ondenzame	ツノザメ科 オンデンザメ
<u>Squalus acanthias</u>	Spiny dogfish, Dogfish	Abura taunozame	アブラツノザメ
<u>RAJIDAE</u>			
<u>Bathyraja abyssicola</u>	Skates Deepsea skate	Gangiei-ka Chihiro kasube	ガンギエイ科 チヒロカスベ
<u>Bathyraja kincaidii</u>	Sandpaper skate, Black skate	(Soko gangiei no isshu)	(ソコガンギエイの一種)
<u>Bathyraja lindbergi</u>	(Skate)	Komandoru kasube	コマンドルカスベ
<u>Bathyraja maculata</u>	(Skate)	Monteuki kasube	モンツキカスベ
<u>Bathyraja parmifera</u>	Alaska skate	Kitatsuno kasube	キタツノカスベ
<u>Bathyraja trachura</u>	Roughtail skate, Black skate	Yasuda kasube	ヤスダカスベ
<u>Raja binoculata</u>	Big skate	(Gangiei no isshu)	(ガンギエイの一種)
<u>Raja rhina</u>	Longnose skate	(Gangiei no isshu)	(ガンギエイの一種)
<u>Raja stellulata</u>	Starry skate	Kohoshi kasube	コホシカスベ
<u>CLUPEIDAE</u>			
<u>Alosa sapidissima</u>	Herrings American shad	Nishin-ka Shaddo*	ニシン科 シヤッド*
<u>Clupea harengus pallasii</u>	Pacific herring, Herring	Nishin	ニシン
<u>Sardinops sagax</u>	Pacific sardine	(Ma iwashi no isshu)	(マイワシの一種)



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ENGRAULIDAE			
<u>Engraulis mordax</u>	 Anchovies Northern anchovy	Katakuchi iwashi-ka (Katakuchi iwashi no isshu)	カタクチイワシ科 (カタクチイワシの一種)
BATHYLAGIDAE			
<u>Bathylagus milleri</u>	Deepsea smelts	Soko iwashi-ka	ソコイワシ科
<u>Bathylagus ochotensis</u>	Stout blacksmelt	Kuro soko iwashi	クロソコイワシ
<u>Bathylagus pacificus</u>	Okhotsk blacksmelt	Soko iwashi	ソコイワシ
<u>Bathylagus schmidtii</u>	Pacific blacksmelt	Yase soko iwashi	ヤセソコイワシ
	Northern smoothtongue	(Soko iwashi no isshu)	(ソコイワシの一種)
OPISTHOPTERIDAE			
<u>Macropinna microstoma</u>	 Spookfishes Barreleye	Deme nigisau-ka Deme nigieu	デメニギス科 デメニギス
OSMERIDAE			
<u>Mallotus villosus</u>	 Smelts Capelin	Kyuri uo-ka Karafuto shishamo	キュウリウオ科 カラフトシシヤモ
<u>Osmerus mordax</u>	Rainbow smelt	Kyuri uo	キュウリウオ
<u>Thaleichthys pacificus</u>	Kulachon	Yurakon	ユーラコン
SALMONIDAE			
<u>Oncorhynchus gorbusha</u>	Salmonids, Salmon and Trout	Sake-ka	サケ科
<u>Oncorhynchus keta</u>	Pink salmon, Humpback salmon	Karafuto masu	カラフトマス
<u>Oncorhynchus kisutch</u>	Chum salmon, Dog salmon	Shiro sake, Sake	シロザケ, サケ
<u>Oncorhynchus masou</u>	Coho salmon, Silver salmon	Gin sake, Gin masu	ギンザケ, ギンマス
<u>Oncorhynchus nerka</u>	Masu salmon, Cherry salmon	Sakura masu	サクラマス
<u>Oncorhynchus rhodurus</u>	Sockeye salmon, Red salmon	Beni sake, Beni masu	ベニザケ, ベニマス
<u>Oncorhynchus tshawytscha</u>	- Chinook salmon, Spring salmon King salmon	Amago, Biwa masu Masunosuke	アマゴ, ビワマス マスノスケ

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<u>Salmo gairdneri</u> ¹	Steelhead trout (anadromous)	Suchiiruheddo (kookai-gata), Nijimasu (hi-kookai-gata)	スチールヘッド (経海型) ニジマス (非経海型)
<u>Salmo mykiss</u> ¹	Rainbow trout (non-anadromous)	Kamchakka torauto	カムチャツカトラウト
<u>Salvelinus alpinus</u>	Kamchatka trout	Hokkyoku iwana, Arupusu iwana	ホツキョクイワナ, アルプスイワナ
<u>Salvelinus malma</u>	Arctic char	Oshorokoma, Karafuto iwana	オシロコマ, カラフトイワナ
	Dolly Varden		
GONOSTOMATIDAE			
	Lightfishes, Bristlemouths	Yokooso-ka	ヨコエソ科
			
CHAULIODONTIDAE			
<u>Chauliodus macouni</u>	Viperfishes	Hooraieso-ka	ホウライエソ科
	Pacific viperfish	Higashi hooraieso	ヒガシホウライエソ
			
MELANOSTOMIIDAE (MELANOSTOMIATIDAE)			
<u>Tactostoma macropus</u>	Scaleless dragonfishes	Hoteieso-ka	ホテイエソ科
	Longfin dragonfish	Hadaka hoteieso	ハダカホテイエソ
			
MYCTOPHIDAE			
<u>Diaphus theta</u>	Lanternfishes	Hadakaiwashi-ka	ハダカイワシ科
<u>Lampanyctus jordanii</u>	California headlightfish (Lanternfish)	Todo hadaka	トドハダカ
<u>Lampanyctus regalis</u>	Pinpoint lampfish	Mame hadaka	マメハダカ
<u>Stenobrachius leucopsarus</u>	Northern lampfish	Mikado hadaka	ミカドハダカ
<u>Stenobrachius nannochir</u>	(Lanternfish)	Kohire hadaka	コヒレハダカ
		Sekki hadaka	セッキハダカ
			
MORIDAE			
<u>Antimora microlepis</u>	Codlings, Longfin code, Morid code, Moras	Chigo dara-ka	チゴダラ科
<u>Laemonema longipes</u>	Pacific flatnose, Longfin cod (Codling)	Kanada dara Itohiki dara	カナダダラ イトヒキダラ
			

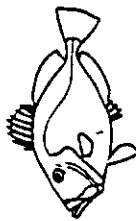
¹Not yet confirmed whether or not they are the same species. *S. gairdneri* is used for steelhead of North American origin and *S. mykiss* for the related species of Asian origin. No distinction is made between these species in high sea catches, where all specimens taken are designated as steelhead trout.

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GADINAE	Codfishes	Tara-ka	タラ科
<u>Boreogadus saida</u>	Arctic cod	Hokkyoku dara	ホッキョクダラ
<u>Eleginus gracilis</u>	Saffron cod, Northern cod	Komai	コマイ
<u>Gadus macrocephalus</u>	Pacific cod, Gray cod, True cod	Ma dara	マダラ
<u>Merluccius productus</u> ^{1,2}	Pacific hake, Hake	Pasifikku heiku*	パシフィックヘイグ*
<u>Microgadus proximus</u> ¹	Pacific tomcod	(Tara no isshu)	(タラの一種)
<u>Theragra chalcogramma</u> ¹	Walleye pollock, Pollock, Pacific pollock, Bigeye	Suketo dara	スケトウダラ
MACROURIDAE	Grenadiers, Rattails	Sokodara-ka	ソコダラ科
<u>Coryphaenoides pectoralis</u> (<u>Albatrossia pectoralis</u>)	Giant rattails, Pectoral rattails, Giant grenadier	Mune dara	ムネダラ
<u>Coryphaenoides acrolepis</u>	Pacific grenadier, Roughscale rattail	Ibarahige	イバラヒゲ
<u>Coryphaenoides cinereus</u>	(Rattail)	Karafuto sokodara	カラフトソコダラ
<u>Coryphaenoides longifilis</u>	(Rattail)	Himo dara	ヒモダラ
ONEIRODIDAE	Dreamers	Rakuda anko-ka	ラクダアンコウ科
<u>Oneirodes bulbosus</u>	(Dreamer)	Yume anko	ユメアンコウ
<u>Oneirodes carlsbergi</u>	(Dreamer)	(Yume anko no isshu)	(ユメアンコウの一種)
<u>Oneirodes thompsoni</u>	(Dreamer)	(Yume anko no isshu)	(ユメアンコウの一種)



¹These are also called "whiting" in English. The name "whiting" is now used for hake in the United States and mainly for pollock or tomcod in Canada.
²Some references, including Nelson (1984) and Bachmeyer, et al. (1983) place genus Merluccius under the family MERLUCCIIDAE.

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<i>Cololabis saira</i>	Sauries Pacific saury	Sanna-ka Sanna	サンマ科 サンマ
<i>MELAMPHAEIDAE</i>	Bigscalefishes, Melamphids (Melamphid)	Kabuto uo-ka (Kabuto uo no isshu) Kabuto uo	カブトウオ科 (カブトウオの一属) カブトウオ
<i>Melanphaea polylepia</i> <i>Poromitra crassiceps</i>	Crested bigscale, Crested melamphid		
<i>ZEIDAE</i>	Dories Coster dory	Matodai-ka Oome matodai	マトダイ科 オオメマトウダイ
<i>Alloccyttus verrucosus</i> ¹			
<i>HYPOPTYCHIDAE</i>	Sand eels Dybowski's sand eel	Shiwa ikanago-ka Shiwa ikanago	シワイカナゴ科 シワイカナゴ
<i>Hypoptychus dybowskii</i>			
<i>SCORPAENIDAE</i>	Rockfishes, Scorpionfishes	Fusakasago-ka, Menuke-rui	フサカサゴ科, メヌケ属
<i>Sebastes aleutianus</i>	Rougheye rockfish, Blackthroat rockfish	Ara menuke	アラメヌケ
<i>Sebastes alutus</i>	Pacific ocean perch, Longjaw rockfish	Arasuka menuke	アラスカメヌケ
<i>Sebastes auriculatus</i>	Brown rockfish	Cha menuke*	チャメヌケ*
<i>Sebastes aurora</i>	Aurora rockfish	Oorora menuke*	オオロラメヌケ*
<i>Sebastes babcocki</i>	Redbanded rockfish	Aka shima menuke*	アカシマメヌケ*
<i>Sebastes borealis</i>	Shortraker rockfish	Kita oo menuke*	キタオオメヌケ*
<i>Sebastes brevispinis</i>	Silvergray rockfish	Gin menuke*	ギンメヌケ*
<i>Sebastes caurinus</i>	Copper rockfish	Akagane menuke*	アカガネメヌケ*



¹ Some references, including Nelson (1984) and Eschmeyer et al. (1983), place genus *Alloccyttus* in the family OREOSOMATIDAE.

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<u>Sebastes ciliatus</u>	Dusky rockfish	Ao meharu, Usuzumi menuke*	アオメハル, ウスズミメヌケ
<u>Sebastes crameri</u>	Darkblotched rockfish	Kurobuchi menuke*	クロブチメヌケ
<u>Sebastes diploproa</u>	Splitnose rockfish	Hanaake menuke*	ハナサケメヌケ
<u>Sebastes elongatus</u>	Greenstriped rockfish	Aosuji menuke*	アオスジメヌケ
<u>Sebastes emphaeus</u>	Puget Sound rockfish	(Menuke no isahu)	(メヌケの一種)
<u>Sebastes entomelas</u>	Widow rockfish	Goke menuke*	ゴケメヌケ
<u>Sebastes flavidus</u>	Yellowtail rockfish	Kiobire menuke*	キオビレメヌケ
<u>Sebastes goodei</u>	Chillipepper	(Menuke no isahu)	(メヌケの一種)
<u>Sebastes helvomaculatus</u>	Rosethorn rockfish	Toge menuke*	トゲメヌケ
<u>Sebastes jordani</u>	Shortbelly rockfish	(Menuke no isahu)	(メヌケの一種)
<u>Sebastes maliger</u>	Quillback rockfish	Itomaki menuke*	イトマキメヌケ
<u>Sebastes melanops</u>	Black rockfish	Amerika kuro menuke*	アメリカクロメヌケ
<u>Sebastes melanostomus</u>	Blackgill rockfish	(Menuke no isahu)	(メヌケの一種)
<u>Sebastes miniatus</u>	Vermillion rockfish	Shu menuke*	シュメヌケ
<u>Sebastes mystinus</u>	Blue rockfish	Kuro meharu*, Ao menuke*	クロメハル*, アオメヌケ
<u>Sebastes nebulosus</u>	China rockfish	Shina menuke*	シナメヌケ
<u>Sebastes nigrocinctus</u>	Tiger rockfish	(Menuke no isahu)	(メヌケの一種)
<u>Sebastes paucispinis</u>	Bocaccio	Bokachio*	ボカチオ
<u>Sebastes pinniger</u>	Canary rockfish	Orenji menuke*	オレンジメヌケ
<u>Sebastes polyspinis</u>	Northern rockfish	Kitano menuke	キタノメヌケ
<u>Sebastes proriger</u>	Redstripe rockfish	Akasuji menuke*	アカスジメヌケ
<u>Sebastes reedi</u>	Yellowmouth rockfish	Kiguchi menuke*	キグチメヌケ
<u>Sebastes ruberrimus</u>	Yelloweye rockfish, Red snapper	(Menuke no isahu)	(メヌケの一種)
<u>Sebastes saxicola</u>	Stripetail rockfish	(Menuke no isahu)	(メヌケの一種)
<u>Sebastes variegatus</u>	Harlequin rockfish	Madara akaao*	マダラアカウオ
<u>Sebastes wilsoni</u>	Pygmy rockfish	(Menuke no isahu)	(メヌケの一種)
<u>Sebastes zacentrus</u>	Sharpchin rockfish	Ago menuke*	アゴメヌケ
<u>Sebastolobus alascanus</u>	Shortspine thornyhead	Araake kichiji, (Kinkin)	アラスカキチジ, (キンキン)
<u>Sebastolobus altivelis</u>	Longspine thornyhead	(Kichiji no isahu, Kinkin)	(キチジの一種, キンキン)
<u>Sebastolobus macrochir</u>	(Thornyhead)	Kichiji	キチジ

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ANOLOPOMATIDAE			
<u>Anoplopoma fimbria</u>	Sablefishes Sablefish, Blackcod	Gindara-ka Gindara	ギンダラ科 ギンダラ
HEXAGRAMMIDAE			
<u>Hexagrammos decagrammus</u>	Greenlings Kelp greenling	Ainane-ka Azaeuka ainame	アイナメ科 アラスカアイナメ
<u>Hexagrammos lagocephalus</u>	Rock greenling	Usagi ainame	ウサギアイナメ
<u>Hexagrammos stelleri</u>	Whitespotted greenling	Ezo ainame	エゾアイナメ
<u>Ophiodon elongatus</u>	Lingcod	Kin mutsu*	キンムツ*
<u>Pleurogrammus monopterygius</u>	Atka mackerel	Kitano hokke	キタノホッケ
<u>Zaniolepis frenata</u>	Shortspine combfish	(Ainame no isshu)	(アイナメの一種)
COTTIDAE			
<u>Artediiellus pacificus</u>	Sculpins Pacific hookhorned sculpin, Hookhorned sculpin	Kajika-ka Oki kajika	カジカ科 オキカジカ
<u>Artediiellus uncinatus</u>	Arctic hookear sculpin	(Oki kajika no isshu)	(オキカジカの一種)
<u>Blepsias bilobus</u>	Crested sculpin	Hokake anahaze	ホカケアナハゼ
<u>Dasycottus setiger</u>	Spinyhead sculpin	Ganko	ガンコ
<u>Enophrys dicerus</u>	Antlered sculpin	Oni kajika	オニカジカ
<u>Gymnancistrus galeatus</u>	Armorhead sculpin	Chikame kajika	チカメカジカ
<u>Gymnancistrus pistilliger</u>	Threaded sculpin	Hage kajika	ハゲカジカ
<u>Gymnancistrus tricuspis</u>	Arctic staghorn sculpin	Shiberia tsumaguro kajika	シベリアツマグロカジカ
<u>Hemilepidotus hemilepidotus</u>	Red Irish lord	Hon yokosuji kajika	ホンヨコスジカジカ
<u>Hemilepidotus jordanii</u>	Yellow Irish lord	Name yokosuji kajika	ナメヨコスジカジカ
<u>Hemilepidotus papilio</u>	Butterfly sculpin	Kujaku kajika	クジャクカジカ
<u>Hemilepidotus spinosus</u>	Brown Irish lord	(Yokosuji kajika no isshu)	(ヨコスジカジカの一種)

*Nelson (1984) and Eschmeyer et al. (1983) place Zaniolepis in the family ZANIOLEPIDIDAE.

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<u>Hemitripterus bolini</u>	Bigmouth sculpin	Kemushi kajika modoki	ケムシカジカモドキ
<u>Icelinus borealis</u>	Northern sculpin	(Kajika no isshu)	(カジカの一属)
<u>Icelus canaliculatus</u>	(Sculpin)	Kuro koori kajika	クロコオリカジカ
<u>Icelus scutiger</u>	(Sculpin)	Koorimatsu kajika	コオリマツカジカ
<u>Icelus spiniger</u>	Thorny sculpin	Koori kajika	コオリカジカ
<u>Icelus uncinallis</u>	(Sculpin)	Hime koori kajika	ヒメコオリカジカ
<u>Malacocottus kincaidii</u> ¹	Blackfin sculpin	Montsuki kajika	モンツキカジカ
<u>Malacocottus zonurus</u> ¹	(Sculpin)	Kobushi kajika	コブシカジカ
<u>Myoxocephalus axillaris</u>	(Sculpin)	Nezumi kajika	ネズミカジカ
<u>Myoxocephalus jaok</u>	Plain sculpin	Oku kajika	オクカジカ
<u>Myoxocephalus mednius</u>	(Sculpin)	Ana kajika	アナカジカ
<u>Myoxocephalus polyacanthocephalus</u>	Great sculpin	Toge kajika	トゲカジカ
<u>Myoxocephalus quadricornis</u>	Fourhorn sculpin	(Giesu kajika no isshu)	(ギスカジカの一属)
<u>Myoxocephalus scorpius</u>	Shorthorn sculpin	(Giesu kajika no isshu)	(ギスカジカの一属)
<u>Myoxocephalus verrucosus</u>	Warty sculpin	Ibo giesu kajika	イボギスカジカ
<u>Nautichthys pribilovius</u>	Eyeshade sculpin	Okoze kajika	オコセカジカ
<u>Triglopa macellus</u>	Roughspine sculpin	Yase karafto kajika	ヤセカラフトカジカ
<u>Triglopa metopias</u>	(Sculpin)	(Hokkyoku kajika no isshu)	(ホッキョクカジカの一属)
<u>Triglopa pingeli</u>	Ribbed sculpin	Hokkyoku kajika	ホッキョクカジカ
<u>Triglopa scepticus</u>	Spectacled sculpin	Nirami kajika	ニラミカジカ
<u>Zesticelus profundorum</u>	Flabby sculpin	(Soko kajika no isshu)	(ソコカジカの一属)


PSYCHROLUTIDAE

Psychrolutes phrictus

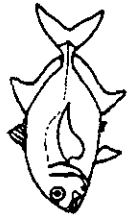
Blob sculpin

ニュードウカジカ

Nelson (1984) places Malacocottus in the family PSYCHROLUTIDAE.

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AGONIDAE			
<u>Agonus acipenserinus</u>	Poachers 	Tokubire-ka	トクビレ科
<u>Agonus decagonus</u>	Sturgeon poacher	Kitano tokubire	キタノトクビレ
<u>Aspidophoroides bartoni</u>	Atlantic poacher	Chigo tokubire	チゴトクビレ
<u>Aspidophoroides olraki</u>	Aleutian alligatorfish	Tate tokubire	タテトクビレ
<u>Bathyagonus alascanus</u>	Arctic alligatorfish	(Tate tokubire no ieshu)	(タテトクビレの一種)
<u>Bathyagonus nigripinnis</u>	Gray starenout	(Tokubire no ieshu)	(トクビレの一種)
<u>Ocella dodecaedron</u>	Blackfin poacher	(Tokubire no ieshu)	(トクビレの一種)
<u>Ocella verrucosa</u>	Bering poacher	Kamutosachiuo	カムトサチウオ
<u>Pallasina barbata</u>	Warty poacher	(Saburo no ieshu)	(サブローウの一種)
<u>Percis japonicus</u>	Tubenose poacher	Yagluo	ヤゴウオ
<u>Sarritor frenatus</u>	(Poacher)	Inugochi	イヌゴチ
<u>Sarritor leptorhynchus</u>	Sawback poacher	Yase tengu tokubire	ヤセテングトクビレ
	Longnose poacher	Tengu tokubire	テングトクビレ
CYCLOPTERIDAE			
<u>Aptocyclus ventricosus</u>	Snailfishes, Liparids	Kusa uo-ka	クサウオ科
<u>Careproctus bowersianus</u>	Smooth lump sucker	Hotel uo	ホテイウオ
<u>Careproctus colletti</u>	(Snailfish)	(Konnyaku uo no ieshu)	(コンニャクウオの一種)
<u>Careproctus cypselurus</u>	(Snailfish)	Araesuka bikunin	アラスカビクニン
<u>Careproctus furcellus</u>	(Snailfish)	Al bikunin	アイビクニン
<u>Careproctus gilberti</u>	(Snailfish)	Oguro konnyaku uo	オグロコンニャクウオ
<u>Careproctus melanurus</u>	Small dark snailfish	Misaki bikunin	ミサキビクニン
<u>Careproctus ovigerus</u>	Blacktail snailfish	(Konnyaku uo no ieshu)	(コンニャクウオの一種)
<u>Careproctus rastrius</u>	Abyssal snailfish	(Konnyaku uo no ieshu)	(コンニャクウオの一種)
<u>Crystallichthys cyclospilus</u>	Pink snailfish	Sake bikunin	サケビクニン
<u>Glaesodiscus caudatus</u>	Blotched snailfish	Zenigata suishoo uo	ゼニガタスイショウウオ
<u>Glaesodiscus tremebundus</u>	(Snailfish)	(Puurai kusa uo no ieshu)	(フウライクサウオの一種)
<u>Gumicrotremus andriashevi</u>	(Snailfish)	Puurai kusa uo	フウライクサウオ
	Pimpled lump sucker	Kita ibodango	キタイボダンゴ

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<u>Eumicrotremus birulae</u>	(Lumpsucker)	Konpeito	コンペイトウ
<u>Euricrotremus orbis</u>	Pacific spiny lumpsucker	Ibodango	イボダango
<u>Liparis cyclostigma</u>	Polka-dot snailfish	(Kusa uo no isshu)	(クサウオの一種)
<u>Liparis dennyi</u>	Marbled snailfish	(Kusa uo no isshu)	(クサウオの一種)
<u>Liparis megacephalus</u>	(Snailfish)	(Kusa uo no isshu)	(クサウオの一種)
<u>Liparis nanus</u>	Pygmy snailfish	Kobito kusa uo	コビトクサウオ
<u>Nectoliparis pelagicus</u>	Tadpole snailfish	Kanten uo	カンテンウオ
<u>Paraliparis cephalus</u>	Blackbelly snailfish	(Inki uo no isshu)	(インキウオの一種)
<u>Paraliparis dactylopus</u>	Red snailfish	Kokuten inki uo	コクテンインキウオ
<u>Paraliparis pectoralis</u>	(Snailfish)	(Inki uo no isshu)	(インキウオの一種)
<u>Paraliparis ulochir</u>	Broadfin snailfish	(Inki uo no isshu)	(インキウオの一種)
<u>Rhinoliparis attenuatus</u>	Slim snailfish	(Shirohige konnyaku uo no isshu)	(シロヒゲコンニャクウオの一種)
CARANGIDAE			
<u>Trachurus symmetricus</u>	Jacks, Scads	Aji-ka	アジ科
	Jack mackerel	(Ma aji no isshu)	(マアジの一種)
BRAMIDAE			
<u>Brama japonica</u>	Pomfrets	Shimagatsuo-ka	シマガツオ科
	Pacific pomfret	Shimagatsuo	シマガツオ
PENTACEROTIDAE			
<u>Pentaceros richardsoni</u>	Armorhead	Kawabisha-ka	カワビシヤ科
	Pelagic armorhead	Kusakari tsubodai	クサカリツボダイ
BATHYMASTERIDAE			
<u>Bathymaster caeruleofasciatus</u>	Ronquils	Medamauo-ka	メダマウオ科
<u>Bathymaster signatus</u>	Alaskan ronquill	Medamauo	メダマウオ
	Searcher	Soko medamauo	ソコメダマウオ





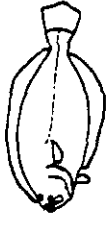
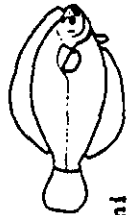
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ZOARCIDAE			
<u>Bothrocara brunneum</u>	Twoline eelpout	Yawa genge	ヤワゲンゲ
<u>Embryx crotalina</u>	Snakehead eelpout	(Genge no isshu)	(ゲンゲの一種)
<u>Lycenchelys camchaticus</u>	(Eelpout)	Hebi genge no isshu	(ヘビゲンゲの一種)
<u>Lycodapus endomacrotus</u>	(Eelpout)	(Ashinaashi genge no isshu)	(アшинаシゲンゲの一種)
<u>Lycodapus fierasfer</u>	Blackmouth eelpout	(Ashinaashi genge no isshu)	(アшинаシゲンゲの一種)
<u>Lycodapus leptus</u>	(Eelpout)	(Ashinaashi genge no isshu)	(アшинаシゲンゲの一種)
<u>Lycodapus poecilus</u>	(Eelpout)	(Ashinaashi genge no isshu)	(アшинаシゲンゲの一種)
<u>Lycodapus psarostomatus</u>	(Eelpout)	(Ashinaashi genge no isshu)	(アшинаシゲンゲの一種)
<u>Lycodes brevipes</u>	Shortfin eelpout	Ashiboso genge	アシボソゲンゲ
<u>Lycodes concolor</u>	(Eelpout)	(Mayugaji no isshu)	(マユガジの一種)
<u>Lycodes diapterus</u>	Black eelpout	(Mayugaji no isshu)	(マユガジの一種)
<u>Lycodes palearis</u>	Wattled eelpout	Hakusen gaji	ハクセンガジ
<u>Lycodes polaris</u>	Canadian eelpout	(Mayugaji no isshu)	(マユガジの一種)
<u>Lycodes faridens</u>	Sparse toothed lycod	Kitano genge	キタノゲンゲ
<u>Lycodes soldatovi</u>	(Eelpout)	Soko gajil	ソコガジ
<u>Lycodes turneri</u>	Polar eelpout	Hokkyoku genge	ホッキョクゲンゲ
<u>Puzanovia rubra</u>	(Eelpout)	Aka genge	アカゲンゲ
STICHAETIDAE			
<u>Funesogrammus praecius</u>	Pricklebacks	Taue gaji-ka	タウエガジ科
<u>Lumpenella longirostris</u>	Fourline snakeblenny	Toge ginpo	トゲギンポ
<u>Lumpenus sackayi</u>	Longsnout prickieback	Nezumi ginpo	ネズミギンポ
<u>Lumpenus maculatus</u>	Pighead prickieback	Yase nezumi ginpo	ヤセネズミギンポ
<u>Lumpenus sagitta</u>	Daubed shanny	Yase ginpo	ヤセギンポ
	Snake prickieback	Unagi gaji	ウナギガジ



 1 Kuro gaji is sometimes used for this species as found in Matsubara (1955) while Ichthyological Society of Japan (1981) uses the name as in this list.

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CRYPTACANTHODIDAE			
<u>Delolepis gigantea</u>	Wrymouths	Hadaka ookamiuo-ka	ハダカオオカミウオ科
<u>Lyconectes alautensis</u>	Giant wrymouth	(Hadaka ookamiuo no isshu)	(ハダカオオカミウオの一属)
	Dwarf wrymouth	(Hadaka ookamiuo no isshu)	(ハダカオオカミウオの一属)
PHOLIDIDAE (PHOLIDAE)			
	Gunnels	Nishiki ginpo-ka	ニシキギンポ科
ANARHICHADIDAE			
<u>Anarhichas orientalis</u>	Wolfishes	Ookamiuo-ka	オオカミウオ科
	Bering wolffish	Ookamiuo	オオカミウオ
ZAPRORIDAE			
<u>Zaprora silenus</u>	Prowfishes	Boozu ginpo-ka	ボウスギンポ科
	Prowfish	Boozu ginpo	ボウスギンポ
CHIASMONTIDAE			
<u>Kali indica</u>	Swallows	Kuro boozugisu-ka	クロボウスギス科
	Black swallower	(Kuro boozugisu no isshu)	(クロボウスギスの一属)
TRICHODONTIDAE			
<u>Trichodon trichodon</u>	Sandfishes	Hatahata-ka	ハタハタ科
	Pacific sandfish	Ezo hatahata	エゾハタハタ
ICOSTRIDAE			
<u>Icosteus aenigmaticus</u>	Ragfishes	Irezumi konnyakuaaji-ka	イレスミコンニャクアジ科
	Ragfish	Irezumi konnyakuaaji	イレスミコンニャクアジ
AMMODYTIDAE			
<u>Ammodytes hexapterus</u>	Sand lances	Ikanago-ka	イカナゴ科
	Pacific sand lance	Kita ikanago	キタイカナゴ



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SCOMBRIDAE			
<u>Sarda chiliensis</u>	Mackerels	Saba-ka	サバ科
<u>Scomber japonicus</u>	Pacific bonito	Hagatsuo	ハガツオ
	Chub mackerel	Ma saba	マサバ
			
CENTROLOPHIDAE			
<u>Ichthyosoma lockingtoni</u>	Medusafishes	Ibodal-ka	イボダイ科
	Medusafish	Kuro abura ibodal	クロアブライボダイ
			
BOTHIDAE			
<u>Citharichthys sordidus</u>	Lefteye flounders	Daruma garei-ka	ダルマガレイ科
<u>Citharichthys stigmatae</u>	Pacific sanddab	(Daruma garei no isshu)	(ダルマガレイの一種)
	Speckled sanddab	(Daruma garei no isshu)	(ダルマガレイの一種)
			
PLEURONECTIDAE			
<u>Atheresthes evermanni</u>	Righteye flounders	Karel-ka	カレイ科
<u>Atheresthes stomias</u>	Kamchatka flounder	Abura garei	アブラガレイ
<u>Emmetsichthys bathybius</u>	Arrowtooth flounder	Arasuka abura garei*	アラスカアブラガレイ*
<u>Eopsetta jordani</u>	Deepsea sole	Shimofuri garei*	シモフリガレイ*
<u>Glyptocephalus zachirus</u>	Petrale sole	Petoraru nameta*, Teubase garei*	ペトラルナメタ*, ツバメガレイ*
<u>Hippoglossoides elassodon</u>	Rex sole	Hirenaga nameta*	ヒレナガナメタ*
<u>Hippoglossoides robustus</u>	Flathead sole	Uma garei	ウマガレイ
<u>Hippoglossus stenolepis</u>	Bering flounder	Doro garei	ドロガレイ
<u>Isopsetta isolepis</u>	Pacific halibut, Halibut	Ohyo	オヒョウ
<u>Lepidopsetta bilineata</u>	Butter sole	Bataa sooru*	バタールソール*
<u>Limanda aspera</u>	Rock sole	Shumushu garei	シュムシュガレイ
<u>Limanda proboscidea</u>	Yellowfin sole	Kogane garei	コガネガレイ
<u>Lipsetta glacialis</u>	Longhead dab	Hana garei	ハナガレイ
<u>Lipsetta exilis</u>	Arctic flounder	(Kuro garei no isshu)	(クロガレイの一種)
	Slender sole	(Kuro garei no isshu)	(クロガレイの一種)
			

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<u>Microstomus pacificus</u>	Dover sole	Doobaa sooru*	ドーバーソール *
<u>Parophrys vetulus</u>	English sole, Lemon sole	Igiriau garei*	イギリスガレイ *
<u>Platichthys stellatus</u>	Starry flounder	Numa garei	ヌマガレイ
<u>Pleuronectes quadrituberculatus</u>	Alaska plaice	Tsuno garei*	ツノガレイ *
<u>Pleuronichthys coenosus</u>	C-O sole	(Meita garei no isshu)	(メイタガレイの一種)
<u>Pleuronichthys decurrens</u>	Curlfin sole	Tana garei*	タマガレイ *
<u>Psettichthys melanostictus</u>	Sand sole	(Karei no isshu)	(カレイの一種)
<u>Reinhardtius hippoglossoides</u>	Greenland turbot	Karasu garei	カラスガレイ

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MUSTELIDAE	Otters	Itachi-ka	イタチ科
<u>Enhydra lutris</u>	Sea otter	Rakko	ラッコ
PINNIPEDIA	Pinnipeds	Hiresashi-ru	ヒレアシ類
OTARIIDAE	Eared seals, Otariode	Ashika-ka	アシカ科
<u>Zalophus californianus</u>	California sea lion	Karifornunia ashika	カリフォルニアアシカ
<u>Eumetopias jubatus</u>	Northern sea lion, Steller sea lion	Todo	トド
<u>Callorhinus ursinus</u>	Northern fur seal	Ottosei	オットセイ
ODOBENIDAE	Walrus	Seiuchi-ka	セイウチ科
<u>Odobenus rosmarus</u>	Walrus	Seiuchi	セイウチ
PHOCIDAE	Earless seals, Phocids	Azarashi-ka	アザラシ科
<u>Phoca vitulina</u>	Harbor seal	Gomafu azarashi	ゴマフアザラシ
<u>Phoca largha</u>	Spotted seal, Larga seal	Zenigata azarashi	ゼニガタアザラシ
<u>Phoca hispida</u>	Ringed seal	Wamon azarashi	ワモンアザラシ
<u>Phoca fasciata</u>	Ribbon seal	Kurakake azarashi	クラカケアザラシ
<u>Erignathus barbatus</u>	Bearded seal	Agohiga azarashi	アゴヒガアザラシ
<u>Mirounga angustirostris</u>	Northern elephant seal	Kita zoo azarashi	キタゾウアザラシ
CETACEA	Cetaceans	Gel-ru	鯨類

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DELPHINIDAE			
<u>Steno bredanensis</u>	Oceanic dolphins	Ma iruka-ka	マイルカ科
<u>Tursiops truncatus</u>	Rough-toothed dolphin	Shiwa iruka	シワハイルカ
<u>Stenella longirostris</u>	Bottlenose dolphin	Bandoo iruka, Handoo iruka	バンドウイルカ, ハンドウイル
<u>Stenella attenuata</u>	Spinner dolphin	Hashinaga iruka	ハシナガイルカ
<u>Stenella coerulescens</u>	Spotted dolphin	Madara iruka, Arari iruka	マダライルカ, アラリイルカ
<u>Delphinus delphis</u>	Striped dolphin, Streaker	Suji iruka	スジイルカ
<u>Lagenodelphis hosei</u>	Common dolphin, Saddleback dolphin	Ma iruka	マイルカ
<u>Lagenorhynchus obliquidens</u>	Frazer's dolphin, Whitebelly dolphin	Sarawaku iruka	サラワクイルカ
<u>Liasodelphis borealis</u>	Pacific whitesided dolphin	Kama iruka	カマイルカ
<u>Grampus griseus</u>	Northern right whale dolphin	Semi iruka	セミイルカ
	Whiteheaded grampus, Gray grampus, Risso's dolphin	Hana gondoo	ハナゴンドウ
<u>Peponocephala electra</u>	Melon-headed whale, Electra, (Blackfish)	Kazuha gondoo	カズハゴンドウ
<u>Feresa attenuata</u>	Pygmy killer whale	Yume gondoo	ユメゴンドウ
<u>Pseudorca crassidens</u>	False killer whale	Oki gondoo	オキゴンドウ
<u>Globicephala macrorhynchus</u>	Short-finned pilot whale, (Blackfish)	Kobire gondoo	コビレゴンドウ
<u>Orcinus orca</u>	Killer whale	Shachi	シヤチ
PHOCOENIDAE			
<u>Phocoena phocoena</u>	True porpoise	Nezumi iruka-ka	ネズミイルカ科
<u>Neophocaena phocaenoides</u>	Harbor porpoise, Common porpoise	Nezumi iruka	ネズミイルカ
<u>Phocoenoides dalli</u> (dalli-type)	Finless porpoise	Sunameri	スナメリ
<u>Phocoenoides dalli</u> (truei-type)	Dall's porpoise (dalli-type)	Ishi iruka, (Kamiyo)	イシイルカ, (カミヨ)
<u>Phocoenoides dalli</u> (black-type)	Dall's porpoise (truei-type)	Rikuzen iruka, (Kamiyo)	リクゼンイルカ, (カミヨ)
	Dall's porpoise (black-type)	Ishi iruka (kokushoku gata), (Kamiyo)	イシイルカ (黒色型), (カミヨ)
MONODONTIDAE			
<u>Delphinapterus leucas</u>	Narwhal and white whale	Ikkaku-ka	イッカク科
<u>Monodon monoceros</u>	Belukha, Beluga, White whale Narwhal	Shiro iruka Ikkaku	シロイルカ イッカク

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PHYSETERIDAE			
<u>Physeter macrocephalus</u> , (<u>P. catodon</u>)	Sperm whales	Makkoo kujira-ka	マッコウクジラ科
	Sperm whale	Makkoo kujira	マッコウクジラ
ZIPHIIDAE			
	Beaked whales	Akaboo kujira-ka	アカボウクジラ科
<u>Berardius bairdii</u>	Baird's beaked whale, Giant bottlenose whale	Tsuchi kujira	ツチクジラ
<u>Ziphius cavirostris</u>	Cuvier's beaked whale, Goosebeak whale	Akaboo kujira	アカボウクジラ
<u>Mesoplodon stejnegeri</u>	Stejneger's beaked whale	Oogiha kujira	オオギハクジラ
<u>Mesoplodon ginkgodens</u>	Ginkgo-toothed beaked whale	Ichoha kujira	イチヲウハクジラ
<u>Mesoplodon carlhubbsi</u>	Hubb's beaked whale	Habbusu oogiha kujira	ハブスオオギハクジラ
ESCHRICHTIIDAE			
	Gray whales	Koku kujira-ka	コククジラ科
<u>Eschrichtius robustus</u>	Gray whale	Koku kujira	コククジラ
BALAENOPTERIDAE			
	Rorqual whales	Nagasu kujira-ka	ナガスクジラ科
<u>Balaenoptera acutorostrata</u>	Minke whale	Koiwashi kujira, Minku kujira	コイワシクジラ, ミンククジラ
<u>Balaenoptera borealis</u>	Sei whale	Iwashi kujira	イワシクジラ
<u>Balaenoptera edeni</u>	Bryde's whale	Nitari kujira	ニタリクジラ
<u>Balaenoptera physalus</u>	Fin whale	Nagasu kujira	ナガスクジラ
<u>Balaenoptera musculus</u>	Blue whale, Sulfur bottom	Shiro nagasu kujira	シロナガスクジラ
<u>Megaptera novaeangliae</u>	Humpback whale	Zatoo kujira	ザトウクジラ
BALAENIDAE			
	Right whales	Semi kujira-ka	セミクジラ科
<u>Balaena mysticetus</u>	Bowhead whale	Hokkyoku kujira	ホッキョククジラ
<u>Eubalaena glacialis</u>	Right whale	Semi kujira	セミクジラ

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HYDROZOA	Hydroids	Hidorochohu-rui	ヒドロ虫類
ANTHOZOA	Sea anemones	Isoginchaku-rui	イソギンチャク類
ANNELIDA	Annelids, Worms	Kankei-doobuteu, Kanchu-rui	環形動物, 環虫類
POLYCHAETA	Polychaetes, Marine worms	Tamoo-rui, Gokai-rui	多毛類, ゴカイ類
ECHIUIROIDEA	Echiurid worms	Yumushi-rui	ユムシ類
MOLLUSCA	Molluscs	Nantai doobuteu	軟体動物
GASTROPODA	Snails	Fukusoku-rui, Maki gai-rui, Taubu	腹足類, 巻貝類, ツブ
BIVALVIA	Clams	Nimaigai-rui	二枚貝類
CEPHALOPODA	Squid and Octopus	Toosoku-rui, Ika-tako-rui	頭足類, イカ・タコ類
DECAPODA	Squids	Juuwan-rui	十腕類
<u>Gonatus magister</u>	Red squid	Dosu ika	ドスイカ
<u>Onychoteuthis borealijaponica</u>	Japanese squid	Taume ika	ツメイカ
<u>Ommastrephes bartrami</u>	Flying squid	Aka ika	アカイカ
OCTOPODA	Octopus	Hachiwan-rui, Tako-rui	八腕類, タコ類
ARTHROPODA	Arthropod	Setausoku doobuteu	節足動物
CRUSTACEA	Crustaceans	Kookaku-rui	甲殻類

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COPEPODA	Copepods	Gyokkyaku-rui	ギョウキヤク類
MYSIDAE	Mysids	Ani-rui	アミ類
ISOPODA	Isopods	Tookyaku-rui	等脚類
AMPHIPODA	Amphipods	Tankyaku-rui	端脚類
EUPHAUSIIDAE	Euphausiids	Okiami-rui	オキアミ類
DECAPODA	Shrimps, Prawns, Crabs	Jikkyaku-rui (Ebi, Kani)	十脚類 (エビ, カニ)
NANTANIA	Shrimps	Choobi-rui, Ebi-rui	長尾類, エビ類
<u>Pandalopsis dispar</u>	Sidestripe shrimp	Hokkoku euji ebi*	ホッコクスジエビ*
<u>Pandalus borealis</u>	Pink shrimp	Hokkoku aka ebi	ホッコクアカエビ
<u>Pandalus goniurus</u>	Humpy, Humpback shrimp	Beni euji ebi	ベニスエビ
<u>Pandalus hypsinotus</u>	Humpback shrimp	(Ebi no isshu)	(エビの一種)
<u>Pandalus jordani</u>	Smooth pink shrimp	(Ebi no isshu)	(エビの一種)
<u>Pandalus platyceros</u>	Spot shrimp, Prawn	Hoshi ebi*	ホシエビ*
BRACHYURA	Crabs	Tanbi-rui, Kani-rui	短尾類, カニ類
<u>Cancer magister</u>	Dungeness crab	(Kani no isshu)	(カニの一種)
<u>Chionoecetes bairdi</u>	Tanner crab, Snow or Queen crab	Zuwai gani	ズワイガニ
<u>Chionoecetes opilio</u>	Tanner crab, Snow or Queen crab	Zuwai gani	ズワイガニ
<u>Chionoecetes tanneri</u>	Tanner crab, Snow or Queen crab	Zuwai gani	ズワイガニ
<u>Chionoecetes</u> sp. hybrid	<u>C. opilio</u> x <u>C. bairdi</u> hybrid	Zuwai gani konketsu shu	ズワイガニ混血種
<u>Erismacrus isenbeckii</u>	Horse crab, Hair crab	Ke gani, Ookuri gani	ケガニ, オオクリガニ

Scientific name	English common name (INPFC preference first)	Japanese standard name or name assigned specifically for INPFC use*	標準和名 又は INPFC 使用名称*
ANOMURA		Ibi-rui	鰐尾類
<u>Paralithodes brevipes</u>	Brown king crab	Hanasaki gani	ハナサキガニ
<u>Paralithodes camtschatica</u>	Red king crab	Taraba gani	タラバガニ
<u>Paralithodes platypus</u>	Blue king crab	Abura gani	アブラガニ
<u>Lithodes aequispina</u>	Golden king crab	Hokuyo ibara gani, Ibara gani modoki	ホクヨウイバラガニ, イバラガニモイ
<u>Lithodes couesi</u>	(King crab)	Kita ibara gani	キタイバラガニ
ECHINODERMATA	Echinoderms	Kyokuhii-doobutsu	キョクヒ動物
ASTEROIDEA	Starfishes	Hitode-rui	ヒトデ類
OPHIUROIDEA	Brittle stars	Kumohitode-rui	クモヒトデ類
ECHINOIDEA	Sea urchins	Uni-rui	ウニ類
HOLOTHURIOIDEA	Sea cucumbers	Namako-rui	ナマコ類